Installation Costs for Industrial Plant Substations*—*Use of Motors in Large Construction Work, and Other Engineering Articles on Station and Operating Practice

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For complete information regarding Model 329 Polyphase Wattmeters and Model 310 Single-Phase and Direct Current Portable Wattmeters, write for Bulletin No. 2002. Other Models in this group are Model 341 A.C. and D.C. Portable Voltmeter, described in Bulletin No. 2004; and Model 370 A.C. and D.C. Portable Ammeter, described in Bulletin No. 2003.

Weston Portable Instrument Transformers are described in Bulletin 2001

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Tungsten Lamp Patent Decision

THE Court of Appeals has just affirmed the decision of the United States District Court sustaining the Just and Hannaman patent for tungsten filament incandescent lamps, thus placing the control of the tungsten lamp situation in the United States in the hands of the General Electric Company and its licensees. The patent specification which was declared valid by the lower court contains a broad claim for an incandescent lamp filament consisting of tungsten in a coherent metallic state and homogeneous throughout. The District Court held that the invention was for a product and not a process, thus covering lamps with squirted filaments as well as those with drawn wire filaments. Herein American jurists differ with those of Great Britain. There last December the Just and Hannaman patent was held to disclose a process and not a product, with the result that to-day in England anyone may manufacture tungsten lamps with squirted filaments without infringing the patent referred to.

Preparedness Propaganda

THE average man looks on preparedness in a purely military way, and unfortunately the parades held in various sections of the country help to emphasize only that phase of the subject. American industry, around which all preparedness talk should center, is, however, often lost sight of. Defense propaganda, while it kindles the slumbering fires of patriotism and calls for pure and unalloyed Americanism, is not the entire spinal column of the preparedness program. Industrial self-reliance, opportunity for American genius, American products and American workmen are important vertebrae. Any program for national defense in time of war that does not involve social and economic security in time of peace is sadly deficient in meeting the nation's needs, and it is well that the two political parties in convention this week should ask that the American shield protect against destruction by foreign competition, as well as from the raiders, political or otherwise at home. We need preparedness not so much from European armies and navies as from European manufacturers and we also should be on the lookout for wider markets.

Electrochemical Economics

IT is well for electrical engineers and more particularly for central station managers in discussing the broader applications of electricity to the electrochemical industry to bear in mind the economics of that situation. Past-President Addicks of the American Electrochemical Society in his recent A.I.E.E. paper brought many of these to the front. While abundant and cheap power is absolutely essential, to carry on successfully the applications of electricity to chemical reactions demands a fine strategic combination of cheap power, good transportation and cheap raw material. Of these three things electrical energy is transported with, on the whole, the most facility up to moderate distances. The raw material and proper distributing facilities for finished product are larger factors in determining the questions of economic location. The labor market, too, has to be considered as a determining factor in the cost of electrochemical production. It unfortunately happens that most of the important waterfalls in this country of a character which permits cheap development are in regions where markets for electrochemical products are small, transportation rather poor and raw materials comparatively inaccessible. Niagara is exceptional, and while there are many electrochemical processes which might be carried on economically by the production of still cheaper power than is available at Niagara, such as the fixation of nitrogen, the two factors of raw materials and proximity to the market will in the great majority of cases be paramount.

Industrial Substation Costs

WE have commented several times recently on the economy and general advantages of the out-door substation, and this week we are glad to be able to give some extremely practical data from one of the large Southern transmission systems dealing in detail with this important subject. The network on which these substations have been erected is a 13,000-volt, three-phase 60-cycle system using the simplest kind of wooden pole line construction. These lines employ chestnut poles of standard N. E. L. A. specifications, carrying six-pin Georgia pine creosoted cross-arms. The transmission wires are supported on pin-type insulators at the ends of the cross-arm and on the pole. The overhead ground wire has not been generally used, but grounded bayonets carried on each pole are employed in some instances for addtional protection. As far as possible the system is arranged to supply power to customers from more than one source. In the out-door substations the transformers as a rule are placed near the ground at the base of the pole which is by far the most accessible location, and are protected by adequate fences inclosing the whole installation. The transformers are sometimes placed on concrete foundations and sometimes on old rails embedded in the earth. In a few cases, notably for the

larger transformers, steel tower structures are used, the transformers still being raised not more than a foot above the ground. It is found in practice that the saving by this construction is considerable. The switches and fuses used are of several types, largely horn gap, sometimes placed directly on top of the transformers so as to be more easily reached. All fuses are tested before installation or renewal.

In the territory covered lightning is the most frequent source of trouble. Electrolytic arresters are used at the ends of the lines and, aside from these, wherever the installation warrants their cost, reactors with horn gaps are freely installed. The metering is on the primary or secondary side according to conditions and when on the former the potential and current transformers and the meter are boxed in, usually on the pole adjacent to the transformers. For this purpose a steel box, with a glass window so that the meter can be read without opening, is used. The meters, lightning arresters and insulators are carefully inspected and frequently tested. The patrolmen keep special watch of insulators, trying them out with a high-resistance telephone receiver connected to ground and pole by two spikes. This procedure results in catching leaking insulators before there have been any interruptions of service.

Of the various items of substation cost data which are given in considerable detail, labor seems to be the most variable, but all the costs are low, running from as little as $3.80 per kilovolt-ampere for a 900-kva. station equipped with electrolytic arresters, to $11.20 per kilovolt-ampere for a 150-kva. station of the simplest character. From $4 to $6 per kilovolt-ampere may be taken as a fair average for stations of 300 to 600 kw. Most of the contracts with customers are for five years and are commonly made on the basis of a service charge or guaranteed minimum payment plus a service charge per kilowatt-hour. The figure for this latter charge varies considerably according to the hours of service, the magnitude of the contract, and the particular arrangement for service charge or minimum guarantee. We believe that the details given in this article will be of very material service to station operators doing miscellaneous industrial business, and the hints on substation construction are particularly well worth study.

Working on Live Lines

THE methods for working on high-voltage lines described in this issue and employed to maintain the integrity of transmission service will open the eyes of a good many ultra-cautious operators. One naturally looks upon conductors carrying from 40,000 to 100,000 volts as things to be let severely alone and to be repaired only when dead. It often happens, however, in transmission service that some fairly important lines are not in duplicate and the shutting down for repairs means cessation of service, always objectionable both to the operator and to the consumer. Yet after all, any voltage in commercial use can be insulated if sufficient care is taken, and Mr. Hardin shows in his article how it is feasible without any particular difficulty to work on these high transmission voltages with entire safety, replacing insulators of either pin or suspension type, and even strain insulators and cross-arms, while the line is steadily in service at its full voltage. The fundamental requisite for this sort of emergency work is a set of first-class, very thoroughly insulated special tools and an abundance of manila rope boiled in paraffine at a temperature low enough to avoid all danger of carbonization. Rope so treated, kept off the ground as much as possible and replaced if there is any reason for doubt about its insulation, enables seemingly impossible feats of working upon live circuits to be performed neatly and expeditiously.

For instance, when it is necessary to change a pin-type insulator at 40,000 or 50,000 volts, the first step is to fit the new insulator with tie wires brought out and left projecting as a pair of horns on each side of the insulator. Then the conductor is side-guyed with insulated rope or propped in a line lifter clamped to the cross-arm, and its tie wires cut and untwisted by means of long-handled, very highly insulated tools. The conductor is then lifted clear of the insulator and further side-guyed or set in the adjustable line lifter, while the old insulator is removed by hand and the new one put in place with the tie wires in accurate line with the conductor, which is then eased off and restored to the insulator groove. Then the tie wire loops are caught by an insulated switch hook and twisted around the conductor. With heavy conductors a forked stick for lifting them is inadequate, therefore the lifting gear shown in one of the illustrations replaces it. The work on suspension-type insulators or strain insulators is performed in an analagous manner, the first step being to take the strain off the lines with a snatch block equipped with insulating rope and then to side guy them, the insulators being uncoupled by means of a forked stick and special tool for pulling the cotter pins. Then the conductor can be pulled to one side until a lineman can comfortably get at the insulators with ample room and change them, when the line is again put back by easing off the guying with the help of the same insulated tools. In this way it has proved easily practicable to change insulators on a 110,000-volt tower line without interrupting service.

The factors in this work which must not be neglected are close attention to the insulation of the apparatus used, caution in keeping the workmen out of the way until the guys and lifting devices have done their work, and great discretion in not working above a wire where an arc might blow, or in damp or rainy weather when the insulation would be imperiled. At first thought the idea of working on a 110,000-volt live line seems a little scary, but as Mr. Hardin shows, the thing can be done and is being done very successfully by means of a combination of special insulating equipment, discretion and common sense on the extensive transmission system operated by his company in the State of Georgia.

Radio-Telegraphy and Preparedness

THE importance of radio communication in war is so great and so manifest that any attempts to support the proposition by argument would be supererogatory. Moreover, the nation which shall have brought the development of radio-telegraphy to the highest pitch before the outbreak of war will, other things being equal, possess a great advantage over its enemies, in so far as relates to long-distance communication with and between its fleets at sea.

Obviously, therefore, the best method of being prepared against hostilities in the field of radio communication is to have plans prepared for the prompt occupation and utilization of all coast radio stations at the first outbreak. There should, on the declaration of martial law, be complete and speedy mobilization of all radio activities by the military and naval forces. But, on the other hand, there should be the minimum of interference by the government with commercial radio communication during times of peace. Radio communication is still a very young art. It hardly goes back to the beginning of this century. Much capital has been honestly invested in it. There is an enormous field for the development of the range, precision, cheapening and improvement of radio signaling. The best way to encourage that development is to give fair play, and free play, to all inventors, business men and industrial forces, whereby, for gain and commercial advantage, it may be possible to enlist the interest and industry of the greatest number of workers in this field.

On the other hand, the surest way to discourage the art, science and engineering of radio communication is to convert the whole field, during peace times, into a monopoly of some department of the government, civil or military. To place all radio signaling in the hands of, say, the navy department, during times of peace, would be to hamper all progress and hinder all development, thus tending to keep America in the background of radio communication, for any purpose peaceful or warlike. This is, of course, no reflection on naval officers or the navy, who in their own field are the pick of the nation and worthy of all our support. It goes without saying, however, that such officers are necessarily too busy with their immediate routine duties to spend much time and money in invention and development in radio engineering. Any monopoly of a great business inevitably leads to lack of competition, to lack of stimulus and to stagnation. Progress comes from holding open the avenues of success to individual talents, industry and enterprise.

Let us hope that the progress and wealth of the nation, in so important and all-pervading a field as radio communication, in time of peace may be fostered by keeping it out of the deadening clutch of government monopoly.

Motor Service in the Chicago Tunnel

THE use by contractors of motors operated from the nearest available service is by no means unusual. The example which we describe in another column, however, is notable on account of its extent and the interesting task in hand. Chicago is building a new tunnel for its water supply from about 4 miles out in Lake Michigan to about 5 miles inland, where a new pumping station will be located. A large part of the power supply required for this huge task is supplied by motors operated from the network of the Commonwealth Edison Company, which also supplies the lighting for the tunnel. There are four shafts which serve as centers of activity from which the debris has been removed and into which the material of construction goes. At each of these shafts is an out-door substation sufficiently powerful to supply the local installation. The individual motors are of from 25 hp. to 100 hp. output and are used for compressors, hoists and fans. The work is being pushed day and night seven days in the week on eight-hour shifts, and no inconsiderable part of the motor service is continuous, particularly that employed in the air compressors which furnish power for the drills and underground concrete mixers. This indirect use of electricity instead of its immediate application is largely due to the extreme wetness of the tunnel, as also probably is the employment of the humble mule instead of a trolley for transporting the material along the shaft. It is a very excellent example of the efficient use of motors in contracting work. In this case the city happens to be the contractor inasmuch as the whole work is being done by the city through its own engineer. Wherever electrical supply is available, as it is now over a very large proportion of the territory where construction work is going on, the contractor can save time and trouble by turning to the central station for help, to say nothing of the saving in cost.

The Coming Issues

NEXT week, in the engineering issue of the ELECTRICAL WORLD for June, the measurement of high potentials by means of the corona voltmeter will be the subject of a leading article of timely interest to engineers and students of high-tension phenomena in general. Methods used to maintain the high dielectric strength of transformer oil will be described in another article which operating men will find useful. In the commercial number of the month, dated June 24, valuable data on electric heating and cooking will be presented, together with articles on lighting topics, on selling, on equipment for motor drive, on testing in the customer's behalf, and on other topics of interest to the dealer, contractor, jobber, manufacturer and central station manager, besides the regular departments for the engineer and operating man. In the first number of July, which, following the usual schedule, will be the public relations number of the month, a complete account will be given of the elaborate methods employed by a leading central station organization to facilitate routine business transactions with its customers and to render to each consumer in time of need the fullest possible service and help.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Jobbers Discuss Organization by Local Sections

Convention at Hot Springs, Va., This Week, Reports Favorably on Plan for Local and National Meetings

A three-day general meeting of the Electrical Supply Jobbers' Association opened on Tuesday morning, June 7, at the Homestead Hotel, Hot Springs, Va. As is customary, the reports of committees were presented to the members without formal papers, and the work of the meeting developed a general discussion of these reports.

The most important subject before the meeting was the report of the survey committee proposing a plan of reorganization. The new plan, which was passed upon favorably, makes necessary certain changes in the by-laws so that it will not go into effect until after the next meeting, early in October.

Group Plan Will Benefit Local Members

The new plan for organization is in line with the development of many other national societies and electrical organizations. Under this plan the membership in the United States will be divided into sections, and each section will form a local group with a chairman and a secretary. The national meetings will handle the broad problems affecting all the groups. Representatives from each district will make up a national executive committee and the national association will contribute toward the expenses of the local meetings.

In the discussion of the proposed plan of reorganization attention was called to the opportunity for carrying on both national and local work in each local group. The jobber can, for example, interchange experiences with his fellow members on the individual problems of his business. He can make his fair profit in two general ways: First, by keeping down his expenses of doing business, and second, by finding out which lines are profitable and which are unprofitable. As a national body, the association can lay before the manufacturer proof of his value as a distributer, by combining the results of members' local investigations. The manufacturer must be informed authoritatively as to what the jobbers' costs really are. Other speakers emphasized the need and value of better accounting methods, so that every jobber can know with certainty where he stands.

Practical Co-operation with Contractors

In discussing the co-operation possible locally between central station, jobber, dealer and contractor, it was stated that on the average 40 per cent of the jobbing business is done through the dealer and contractor. One speaker stated that it has been found possible, because of the broadmindedness of the central station executives in his territory, to establish working relations between the different groups interested. He called attention to the fact that central station men have found it possible to sublet certain classes of construction work to contractors, thereby saving money. White-way lighting, special pole-line work, etc., have been let by the central station on competitive bids from contractors, with satisfactory results. This is but one example of the fact that each group has its functions in a community, and by getting together and discussing the problems, each man would get his share of the work and his profit.

Uniform Cost Accounting

The need for establishing and standardizing uniform cost accounting was another subject discussed at several of the meetings. Members of the association pointed out the opportunity for finding the actual cost of doing business when handling different lines of goods. It was made clear that the manufacturer would better understand the jobber's problem in marketing different lines of goods if the jobber could show the manufacturer authoritative records on his cost of doing business.

Mr. Patterson of the General Electric Company was invited to contribute to this general discussion, and at one of the meetings read a comprehensive paper on the relation between standardized methods of accounting within the industry, and their relation to the activities of the Federal Trade Commission. Mr. Patterson pointed out that because of the technical character of the industry, it is most important that the men in the industry themselves take the initiative in making clear the details of accounting records. He pointed out the general lack of exact knowledge of cost in all lines of activity, including the government's own work. He stated that the different branches of the industry must be prepared to know exactly how their business stands so as to meet any demands which the government might put upon their individual businesses.

Concentric Wiring and the Jobber

During the discussion on concentric-wiring topics the opinion was expressed that the jobbers having nothing to lose in the development of concentric wiring. New wiring methods develop gradually, it was pointed out, and if the new concentric system proves satisfactory in the experimental installations it will be adopted. This would make possible more work for the contractor in wiring old houses and would mean the sale of more and more appliances because of this increase in the number of wired houses.

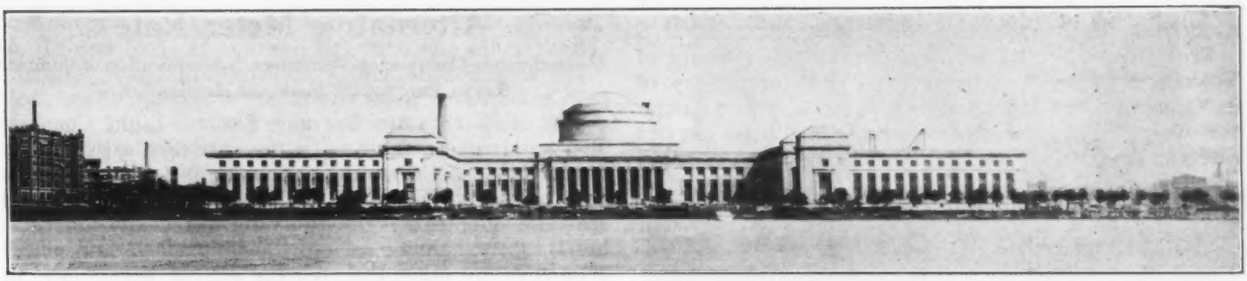
The possibility of establishing a system whereby net prices can be figured from discounts by means of a group of tables was also suggested.

Later meetings were addressed by A. K. Baylor of the General Electric Company, who explained the heating-patent situation to the jobbers, and by Frank Watts, who discussed the value of co-operation with the Jovian order.

Extension of Chicago Street Lighting System

One June 5 the voters of Chicago passed favorably on a bond issue of $3,750,000, the proceeds from the sale of which will be used for the extension of the city's street lighting system.

It is proposed that the extension will include the installation of 5800 600-cp. incandescent lamps, 25,400 100-cp. incandescent lamps with all equipment incident thereto, together with three new substations and one new 2000-kw. generating station. The funds to be derived from this issue will be sufficient, it is thought, to care for Chicago's lighting requirements for the next five years.



GROUP OF BUILDINGS AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY TO BE DEDICATED NEXT WEEK

Large Canadian Hydroelectric Properties Consolidate

At special meetings of the Montreal Light, Heat & Power Company and the Cedar Rapids Manufacturing & Power Company, the consolidation of these corporations under the Civic Investment & Industrial Company was approved.

The new holding corporation will have an authorized capitalization of $75,000,000, of which $65,300,000 will be issued to provide for the acquisition of the stocks of the two underlying companies. For each share of Montreal Light, Heat & Power Company, three shares of stock of the new company will be exchanged, while for Cedar Rapids Manufacturing & Power Company the exchange will be share for share. The agreement under which the two companies will be taken over provides for a ninety-eight year operation of the properties, the new company guaranteeing all fixed charges, operating expenses, maintenance and other charges, with 8 per cent annual dividends on Montreal Light, Heat & Power Company stock and 3 per cent annual dividends on Cedar Rapids Manufacturing & Power Company stock.

The fiscal year of the Civic Investment & Industrial Company will end on April 30, and dividends on its stock, which probably will be at a 4 per cent annual rate, will be payable quarterly beginning Nov. 15, 1916. The new company will be a holding corporation, and operation of both underlying companies will be conducted under the name of the Montreal Light, Heat & Power Company.

Directors of the Civic Investment & Industrial Company will be Sir Herbert H. Holt, president J. S. Norris, vice-president; J. E. Aldred, New York; Sir H. Montague Allen and George Caverhill, Montreal; Arthur V. Davis, Pittsburgh; Sir Rodolphe Forget, C. R. Hosmer, Robert Mackay, Narcisse Perodeau and H. R. Rainville, Montreal.

The Montreal Light, Heat & Power Company controls extensive hydroelectric and steam generating facilities in Montreal, together with transmission and distributing systems covering Montreal, and also the artificial gas business of the city.

It operates the Montreal Gas Company, Royal Electric Company, the Montreal & St. Lawrence Light & Power Company; Imperial Electric Light Company; Lachine Rapids Hydroelectric & Land Company, Ltd., Standard Light & Power Company, Ltd., Citizens Light & Power Company, Ltd., Temple Electric Company and Provincial Light, Heat & Power Company. It is capitalized at $18,700,000 stock paying 10 per cent dividends and $10,713,000 bonds outstanding.

The Cedar Rapids Manufacturing & Power Company now has 100,000 hp. hydroelectric generating capacity, with an additional 60,000 hp., which may be installed as required. The merger of the two companies is the largest public utility consolidation yet made in Canada, and the combined system is one of the largest hydroelectric organizations in the world.

Massachusetts "Tech" to Dedicate New $7,000,000 Plant

Coincident with the fiftieth anniversary of the school, the Massachusetts Institute of Technology is to dedicate its new $7,000,000 group of buildings at Cambridge during the coming week, when a great gathering of scientific men, industrial leaders, educators and alumni will celebrate the occasion. With 730,000 sq. ft. of floor space, the new buildings form an imposing concrete classic group facing the Charles River Basin, the crowning feature being a great library and administration building set at the end of a court 565 ft. deep and 365 ft. wide, surmounted by a concrete dome 180 ft. above the ground. Extensive engineering and chemical laboratories are provided in the wings, and the transfer of apparatus from the Boston buildings of the institution is now in progress in anticipation of the opening of the fall term.

The formal dedication of the new buildings will take place on Wednesday, June 14, with a banquet in the evening at Symphony Hall, at which President Maclaurin and many distinguished guests will address not only those present, but groups of alumni in thirty or more cities scattered from Puget Sound to Georgia and from Louisiana to the Middle West through special telephone arrangements effected by the Bell organization.

The archives will be transferred from the Rogers Building in Boston to their new home on Tuesday evening at dusk in a decorated barge of state modelled after the old Bucentaur, in which the Doges of Venice sailed forth to wed the Adriatic. Upon the arrival of the flotilla a masque and pageant will be held in the court, and 10,000 spectators will witness a display of flood and other special lighting in connection with the performance which will rival that of the San Francisco Exposition of last year. It is expected that Alexander Graham Bell, Thomas A. Edison, Orville Wright, Thomas A. Watson, Theodore N. Vail, John J. Carty and M. I. Pupin will be among the guests on the platform at Symphony Hall Wednesday evening, when the formal celebration will close.

Canadian Electrical Association Convention

The Canadian Electrical Association will on June 21, 22 and 23 hold an excursion convention. It is planned to leave Toronto, Ont., by boat at 3.30 p. m. on June 21 for Kingston. Prescott will be reached at 9.50 a. m. the following morning, and there the association will be joined by delegates from Ottawa, Montreal and Eastern points. The return trip will begin at 11.55 noon, June 22, Toronto being reached at 7 o'clock on the morning of June 23. The business of the convention will be conducted chiefly on the return journey. Alan Sullivan, 910 Excelsior Life Building, Toronto, is secretary-treasurer of the association.

Lighting of Newark During Celebration

From April last on into the coming fall the city of Newark, N. J., will celebrate the 250th anniversary of its founding. An industrial exposition in which a number of electrical interests, including the Public Service Electric Company, the Splitdorf Electric Company,

NEWARK'S CITY HALL ILLUMINATED BY FLOOD LIGHTING

Crocker-Wheeler Company, Edison Storage Battery Company, I. R. Nelson Electric Repairing & Manufacturing Company, General Electric Company and Westinghouse Electric & Manufacturing Company, participated closed on June 3 after three weeks of exhibition. A pageant, parades, concerts, addresses by men of national reputation complete the features of the celebration.

At night the more prominent thoroughfares are brilliantly lighted by a generous use of streamers, and clusters of lamps, outline and flood lighting.

MARKET STREET BY NIGHT DURING CELEBRATION

Alternative Meter Rate

Massachusetts Commission Recommends Modification of Summer Resort Rate for Off-Peak and Heating Loads

The Massachusetts Gas and Electric Light Commission has issued a decision in the rate case of the Vineyard Lighting Company, recommending that the company shall, in addition to its present demand-rate schedule, offer to sell electricity for any use to churches, hotels, stores, shops, saloons, bowling alleys and places of amusement other than moving picture houses, and to all other customers for heating and cooking devices who have installed a special circuit therefore, at a price of 25 cents per kilowatt-hour, with a discount for prompt payment of 5 per cent during the months of June to September inclusive, and of 40 per cent during the remainder of the year; that it shall publicly announce as part of its present schedule readily comprehended rules by which the respective demands of its customers purchasing electricity under that schedule are established; and that it shall charge the regular power rate hereafter for energy sold to the Oak Bluffs Street Railway.

The decision is of particular interest on account of its consideration of the company's system of demand rates, in which a distinction is made between summer and winter prices. The company supplies both gas and electricity in Oak Bluffs and electricity in the towns of Vineyard Haven and Edgartown, on the island of Marthas Vineyard. On June 1, 1915, the company established a new system of demand rates as follows:

Summer Demand Rates. June to September inclusive. Based upon a 25-watt unit (to be agreed upon or measured by a demand indicator):

	Per month
One unit	$1.00
Two units	1.80
Three units	2.40
Additional units	0.60

A minimum season charge of one and a half months' bill and not less than $9 is required before connection.

Demand Rates. October to May inclusive: 0.6 per cent of Summer Demand Rates. Bills paid before the tenth of the month receive a 5 per cent cash discount.

Power Service. Between midnight and 6 p. m.: 7 cents per kilowatt-hour, subject to a minimum bill 14 per cent of Summer Demand Rates.

The financial results of the previous demand rate schedule (outlined in the ELECTRICAL WORLD, Jan. 1, 1916, page 50) provided no adequate provision for depreciation, let alone any return on the invested capital. Less than 15 per cent of the customers were on a metered service.

The new schedule had the effect of increasing the summer rates and was especially felt by those who had previously enjoyed the metered service, particularly the stores, hotels and other business places, and a complaint to the commission was the result. The change in rates was planned to yield additional revenue. No dividends have been earned by the company, and the rates were insufficient to pay full interest on the floating debt.

SEASONAL DIFFERENTIAL

The commission finds that the company is being prudently managed and that the need for additional revenue is imperative in the interests of both the company and of future adequate service for the communities supplied. The permanent population aggregates 4000, with a great increase in summer. The conditions are probably unparalleled in any other area of supply in the state. It was urged with great force in behalf of the petitioners that a meter rate is the only fair rate. Regarding this the Commission says:

"It is true that a kilowatt-hour is now the established unit for measuring electricity. Furthermore, as between

customers with like conditions of supply, it is probably the fairest basis of charge. But this, like other fundamentally sound propositions, either academic or practical, is subordinate to conditions when unusual and controlling. This company's investment has been made virtually entirely to provide for the brief summer business when the largest demand is made for the shortest possible use of electricity for the year. Moreover, the maximum demands of all its customers are coincident. If the plant were operated for the summer season only, the company could not dispense with any of the investment which it now has and its saving in operating expenses would be confined largely to those costs which relate directly to the production of the electricity required to carry the winter load. The situation being as it is, the company's summer customers necessarily have to bear nearly the full burden of the plant, and it is at least doubtful whether a metered rate would provide as fair an apportionment of this burden among them as their respective demands upon the station. In view of these exceptional conditions, the company's plan of a flat rate, based upon the relative demands of its customers, with a large discount to those using electricity during months other than the summer months, has not impressed the board as so inequitable in its theory as to warrant its discontinuance.

"But, while such a rate seems to work out fairly well as applied to the ordinary customers of the company who make a reasonably steady use of their respective demands, there was considerable evidence at the hearings indicating that such might not be the case with hotels, stores and other business places. In some instances these appear to have large but intermittent demands, and in others steady use of their demands varying however considerably in duration. Attention was also directed to churches, which in the nature of things, have but an occasional use of their demands. Makers of rate schedules and public boards who have had the duty of passing upon them have adopted various theories and schedules to adjust such widely differing conditions of supply. There can hardly be claimed to be any principle so sound and universal in its application as to be generally accepted, although it is common to recognize in the rate both factors of demand and consumption. But in view of the fact that the primary question is to secure a fair rate of return, it seems unnecessary to enter into an extended discussion of the merits of different theories and methods employed under normal conditions. An alternative meter rate offered to customers of the classes named will meet the principal objection to the present schedule, however, and experience under the modified schedule during the coming season will tend to prove what further changes are desirable. . . .

"In reaching this conclusion the board should by no means be understood as endorsing generally a demand as superior to a meter rate, but only as related to the peculiar and exceptional circumstances of this case. If the load improves, and as it improves, a gradual change to the meter system may seem best. There are some serious disadvantages in the present plan and not the least is the uneconomical consumption of current by customers once their demands are established. But this last feature under present conditions affects so small a proportion of the costs, as compared with any effective plan for correcting it, that it may be neglected until the hoped-for improvement in the load-factor occurs. The hearings, however, made apparent what might be reasonably expected, that a rate based on the whole or some proportionate part of the connected load calls for the utmost good faith on the part both of the company and of the customer. It should be applied not as a matter of special agreement but by rules definitely established and publicly announced."

Flood Lighting the Statue of Liberty

As previously mentioned in these columns, there is a plan on foot to raise by popular subscriptions sufficient money to enable the Statue of Liberty on Bedloe's Island, New York Harbor, to be permanently and suitably illuminated at night by means of flood lighting. The plan has received the sanction of Congress and contributions are being solicited by the New York *World*. That newspaper in 1885 raised by popular subscription the last $100,000 to complete the pedestal on which the statue rests. It is collecting now $30,000 for electrical equipment and energy to set off the famous Bartholdi statue by night, as shown in the accompanying engraving. The photograph from which the engraving was made was taken on the night of May 31, 1916, when the statue was illuminated by the projectors of the battleship Michigan. The plan was brought to the attention of the National Electric Light Association by Henry L. Doherty at its recent convention in Chicago where it received the indorsement of the electrical fraternity.

Tungsten Lamp Patent Upheld

The United States Court of Appeals this week affirmed the decision of Judge Mayer of the United States District Court for the Southern Division of New York on the Just and Hannaman patent No. 1,108,502 for "incandescent bodies for incandescent lamps." The suit was won by the General Electric Company against the Laco-Phillips Company which imports all of its lamps from Holland. A rather full account of Judge Mayer's decision and of the provisions of the patent on which his decision was based will be found in the ELECTRICAL WORLD for Feb. 19, 1916. Both the squirted and drawn wire filament lamp imported by the defendant were held to infringe the patent.

Great Western Power Installs 400 Electric Ranges in One Year

Throughout the Far West the slogan "Cook by Wire" has taken on a very definite meaning, and the sale of the electric range is assuming considerable proportions. One of the companies that has made a determined effort to develop electric cooking is the Great Western Power Company of San Francisco. In his annual report for 1915 President M. Fleishhacher tells of the progress made by the company in promoting electric range sales.

"During the past year," he said, "a definite campaign was entered into for introducing to consumers on our lines the use of electricity for cooking and water-heating, both in residences and restaurants. Our work in this direction started on April 1, 1915, with the result that we have installed on our service lines about 400 electric ranges and 150 electric water heaters. We have also given consideration to other large industrial heating and current-consuming devices such as large bake ovens for enameling, bread-baking, etc., and a considerable number of these are also now in use on our system.

"Installations for electric cooking and heating have proved uniformly satisfactory, and our efforts in this line are being expanded in the anticipation of its affording an important source of revenue.

"This new class of service is a particular boon to consumers living in the country and suburban districts where there are no existing gas facilities, but it is likewise proving both practicable and popular in the small towns and large cities served by us."

Construction Plans of Insull Companies

The Public Service Company of Northern Illinois and the Commonwealth Edison Company of Chicago are petitioning the Public Utilities Commission of Illinois for authority to erect an addition to the Blue Island Station of the Public Service Company of Northern Illinois. The addition contemplated will have an immediate rating of 12,500 kw. in one unit, and an ultimate rating of 25,000 kw. Under the plan which has been proposed the two companies will effect an operating agreement, the terms of which in general are as follows:

The Commonwealth Edison Company will lease the land for the station from the Public Service Company, build the station and install a 12,500-kw. unit. The station itself will be operated by the Public Service Company with the force which it is now using and The Commonwealth Edison Company will take the entire output except at such times as the entire rated capacity of the machine is not needed, when its output may be used by the Public Service Company. The Commonwealth Edison Company will pay the Public Service Company on a kilowatt-hour basis, the operating expenses of the entire station being kept in one series of accounts and pro-rated on the basis of station kilowatt-hour output. Since the investment is being made by the Commonwealth Edison Company, it will pay the Public Service Company no primary charge. The Public Service Company will pay the Commonwealth Edison Company a fixed sum per month for that portion of the building not used for the initial installation, and will at the end of a definite period acquire the entire additional power house property at a price to be fixed at that future time by a board of appraisers.

This plan for serving the customers of the Commonwealth Edison Company in the southern part of Chicago has been adopted as the most economical means under the present conditions.

Chicago Linemen Return to Work

The strike of linemen and meter testers in the employ of the Commonwealth Edison Company, which has been in effect since May 17, was compromised on June 5 after a conference between W. L. Abbott, chief operating engineer of the company, and officials of the Brotherhood of Electrical Workers. The men had struck for increased wages and recognition of their union. The company refused to recognize the union but was willing to increase the men's wages. The settlement is a compromise, since all wages are to be increased, and those desiring to carry union cards are to be permitted to do so. Although the men demanded an increase of 30 per cent they have now voted to accept 16 per cent, which represents an increase of 50 cents a day for linemen, 25 cents a day for groundmen, $16 a month for workers on a monthly basis, and $10 a month for foremen. The meter testers will receive increases ranging from $5 to $20 according to length of service with the company.

A few days previous to the settlement of the strike eight men were arrested. They had been touring the city in automobiles dynamiting the company's property, and their arrest is thought to have had not a little influence in assisting toward a settlement. During the strike these men had committed no less than twelve blow-up jobs, to poles and manholes, and when captured 250 sticks of dynamite, sixteen boxes of nitro caps, fulminating caps, cartridges, revolvers and fuses were confiscated. In addition to the dynamiting, numerous meters were damaged and numbers of large apartment buildings were cut off during the evening. Blow torches were placed in manholes, burning cables and resulting in short-circuits. The dynamiters have confessed being employed by the Brotherhood of Electrical Workers Union No. 9 at a rate of $6 per day for their services.

At the commencement of the strike threat was made that all the operators in the company's power houses and substations were coming out in sympathy. These men remained loyal to the company, however, but a petition was signed by every man in the operating force asking for increased wages. It was pointed out in the petition that electric light rates had recently been reduced to the public, the saving accruing to them representing about $1,000,000 annually. The men asked for higher wages on the grounds that the company if able to save the public to this amount ought to be able to pay higher wages. The demand has been met, not to the extent of 25 per cent as petitioned, but a "substantial increase" is promised.

Associated Manufacturers of Electrical Supplies

At the meeting of the molded or formed insulation section, held Monday at the Hotel Biltmore, New York City, all of the officers of the section were re-elected for the coming year as follows: Chairman, E. B. Hatch, Johns-Pratt Company, Hartford, Conn.; secretary, R. W. Seabury, Boonton Rubber Manufacturing Company, Boonton, N. J.; treasurer, Joseph Steinberger, General Insulate Company, Brooklyn, N. Y.

At the Biltmore, on Monday, a new section was formed, called the line material section. A. L. Wilkinson, of the Ohio Brass Company, was temporary chairman of the meeting. H. L. Garbutt, of the Westinghouse Electric & Manufacturing Company, was elected permanent secretary and Robert C. Buell, of the Johns-Pratt Company, permanent treasurer. The permanent

chairman will be appointed at the next meeting of the Board of Governors to be held on June 21. After the appointment of the chairman the work of further organizing the section will be taken up, committees appointed, and plans laid for many activities.

At the meeting of the fuse section held at Lennox, Mass., on June 1 and 2, H. R. Sargent, of the General Electric Company, was named for chairman; F. V. Burton, of the Bryant Electric Company, for treasurer, and R. C. Buell, of the Johns-Pratt Company, secretary for the ensuing year, all of the above being the same officers as last year.

National Electrical Contractors to Discuss Concentric Wiring

During the annual convention of the National Electrical Contractors' Association in New York City, next July, the code committee proposes to make an exhibit of concentric wiring systems and electrical contractors will be invited to discuss all phases of the subject. The thought and wish of the committee is that the discussion shall be purely educational and not partisan. Samples of switches, receptacles and other devices will be used to show the details, method of attachment, etc., in addition to a concentric wiring exhibit showing panelboards with single-pole fuses, etc. The morning of July 20 nas been set aside for the discussion of concentric wiring.

Many Electrical Marchers in Chicago's Preparedness Parade

In numbers of paraders the electrical industry was one of the large contributors to the success of Chicago's preparedness parade on June 3. The grand total of the paraders, including both civilian and military marchers, was 130,214. Of this number 7876 were contributed by the electric and gas companies, the surface lines and elevated railways, 3994 by the electrical industries and trades, 2330 by the engineering societies, 526 by the telegraph companies, 7386 by the telephone company, the latter figure including telephone operators.

Samuel Insull, president of the Commonwealth Edison Company, led that section of the parade in which the utility employees marched. The engineers' section of the parade was led by Bion J. Arnold, a member of the National Naval Consulting Board, and by the following four members of the Illinois committee of the Naval Consulting Board: P. Junkersfeld, F. K. Copeland, R. W. Hunt and William Hoskins. Gen. George H. Harries, of Omaha, Neb., led one division of the marchers. Gardner S. Williams, of Ann Arbor, Mich., a member of the Michigan committee of the Naval Consulting Board, also marched with the Illinois committee.

ENGINEERS' DIVISION HEADED BY B. J. ARNOLD

PUBLIC UTILITIES DIVISION HEADED BY SAMUEL INSULL PASSING COMMONWEALTH EDISON BUILDING

Electric Taxicabs for Chicago

Following the lead of Detroit, Chicago will have electric taxicab service. Guy Woods, the owner of the American Motor Livery Company of Chicago, has recently placed an order with the Milburn Wagon Company for twelve specially built electric town cars to be equipped with every fine appointment which the most fastidious of high-class livery service demands. These cars are to be delivered by Nov. 1, and will be ready for immediate service.

The design of the cab has been carefully chosen after consulting the most prominent transportation authorities. The new electric cab will be of the limousine type, and will accommodate five passengers. Mr. Woods visited Detroit and carefully studied the electric taxicabs used in that city, and the results of his investigation have prompted him to make this radical change from the gasoline service which he has been offering for a number of years, being one of the first large livery companies to make the change from horse-drawn to gasoline vehicles. Mr. Woods is convinced that the time is ripe for electric vehicle service, and that the Chicago public demands something better than the present gasoline car familiar to patrons of gasoline taxicab services.

The initial order of twelve cabs will in all probability be increased later by another order of twenty-five or thirty more, making a fleet of possibly forty electric taxicabs.

Electric taxicabs have for some time past been operated successfully in Detroit. The Detroit Taxicab & Transfer Company now operates a fleet of seventy-five electric cabs.

Methods for Working on Live High-Voltage Lines

Special Arrangements and Apparatus Used by Georgia Railway and Power Company When Changing Insulators, Remodeling and Rebuilding Overhead Circuits Up to 110,000 Volts Without Interrupting Service

By J. O. Hardin

Engineer of Construction, Georgia Railway & Power Company

"WHEN can we clear this line?" is a question frequently asked of load dispatchers, or system operators, as they are sometimes called. In fact, examination of many interruption records for systems operating at pressures above 6600 volts will usually show a high percentage of the total lines "out" to permit repairs. Rarely is any attempt made to change this condition except to "hold off" the circuits that can be cut out during no-load or light-load periods. Probably the explanation is that precedent has set the practice of de-energizing high-voltage lines before allowing work on them. It is surprising, however, that operating records and customers' impressions of the service should be deliberately spoiled by allowing such interruptions when the remedy is simple and only requires a little ingenuity on the part of the person directing the work. Under favorable conditions, immunity from danger can be depended on without de-energizing lines by the use of paraffine-impregnated manila hemp rope as an insulating medium, and the skillful manipulation of switch sticks with special heads to serve as mechanical hands, to hold tools, etc. Additional equipment may be required in the way of spring clamps and rigging for holding the modified switch sticks, but in any event the work may be conducted with almost as much, if not as much, dispatch as in the ordinary way, and certainly without any interruption to service. It may be pointed out that the company with which the writer is connected never permits a deliberate interruption to service without first exhausting every possible resource at its disposal to accomplish the result while the circuit is energized. Since continuity of service is a measure of its value, consumers appreciate this policy and their satisfaction is a most valuable advertisement for central station service. Some of the methods employed by the Georgia Railway & Power Company for repairing, maintaining and remodeling overhead high-tension lines will, therefore, be explained in what follows:

Insulator Changing

Changing insulators is probably the most important part of routine and special line maintenance in view of the fact that they form such a vulnerable part of any high-tension electric system and because so many are used. Although a relatively large number of high-voltage insulators fail without warning, due to surges, defective units may often be detected before they cause electric disturbances, thus affording numerous opportunities of replacing them while the line is "hot." This is especially true on ungrounded systems, because failure of insulation on one conductor only disturbs the electrostatic balance with respect to earth, thereby altering the charging current at high potential.

In working on live lines, several precautions should be observed. One is to keep below the conductors so that in case an arc occurs it will rise. Another advisable rule for linemen is to keep the pole, cross-arm or part of the insulator-changing rigging between their bodies and line conductors, so that if anything breaks, a conductor will not hit them. In addition, linemen should keep their minds on what they are doing and should not get excited or hurry.

Replacing Pin-Type Units

Pin-type insulators are the simplest to change. Preparatory to such operations, the new insulator is equipped with tie wires (each about 3 ft. long) with loops in each end. Each tie wire is bent around the insulator neck so that the ends meet and extend in

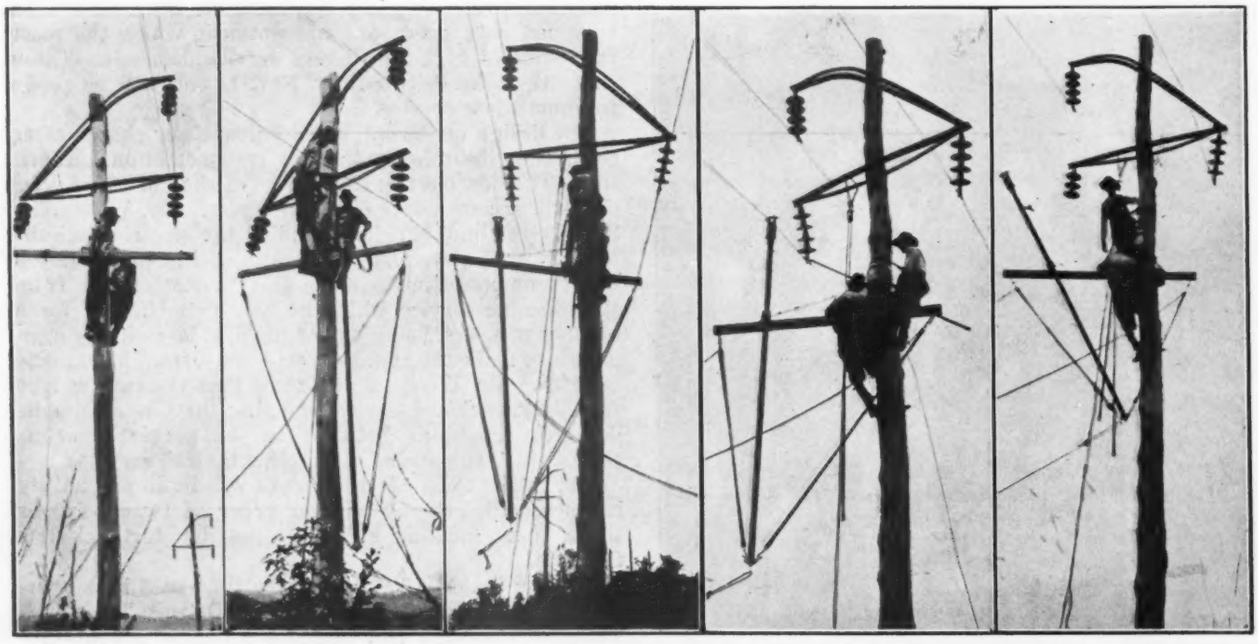


FIG. 1—STEPS IN THE CHANGING OF INSULATORS ON A LIVE 60,000-VOLT LINE WITH THE DEVICES SHOWN IN FIG. 3

the direction of the groove, both ends of one tie wire being on the opposite side of the insulator from the other pair. Each pair is then twisted together close to the insulator and bent so they extend vertically but diverge slightly. Then the tie wire is removed from the insulator to be replaced by cutting with a knife-edge hook, or unwrapped from the conductor by inserting a sharpened horn of a switch stick under one end of the tie wire and twisting the stick. When the unserved portion of the tie wire becomes so long as to be awkward to handle, it may be cut off by means of a hacksaw and the process of unwrapping continued. In the very worst cases the tie wire does not have to be cut more than twice.

While removing the tie wire the line conductor should be side guyed or propped in a line lifter to prevent its shifting position and causing damage when separated from the insulator. After the conductor is lifted clear of the insulator with a fork or "Y" stick, the old insulator is removed by hand, the new one put in place with the tie wires in line with the conductor and the latter lowered into the insulator groove provided for it. With this done, the tie wire loops are seized in turn by a switch hook and "served" or twisted around the conductor. Linemen can become very adept in this operation and make as neat appearing ties as can be made with pliers. The tie wire loops are twisted off close to the conductor by turning the switch hook a few times. When two insulators are close together as in double-arm construction, usually one tie wire per insulator is used.

If the conductor is too heavy to handle with a fork stick, the lifting device marked *K* in Fig. 3 may be used. On lines operating at 40,000 volts and below, the lifting pole may be mounted in a cross-arm hook, but on higher voltages it should be mounted on its own cross-arm. By fastening the insulator changer halfway between two pin insulators, both insulators may be changed without remounting the changer. When there is any side stress either the lifting machine or a paraffine-treated rope and switch stick are used. The operations described can be performed in less than five minutes under favorable conditions, and in fifteen to twenty minutes at the most under the worst conditions of installing rigging to care for side and vertical strains.

CHANGING SUSPENSION AND STRAIN INSULATORS

Suspension insulators may be changed in approximately the same manner as pin-type insulators, except that no tie wires have to be handled. Being employed usually on much higher voltage lines, however, suspension insulators must be changed with higher insulated tools. A conductor-lifting pole like that mentioned before is employed to take the conductor weight off the insulators while the cotter key, between the insulators and the line hanger, is being pulled to separate them. With this done, the line conductor may be propped at a safe distance to permit replacing the insulators. The new ones may be readily coupled to the line by holding the latter where desired in the line lifter and driving the cotter key home with the cotter key puller.

Replacing dead-end insulators may be performed essentially the same on all voltage lines except where a large number of disks are connected in series. Under such conditions a cradle is used to hold all insulators except the one nearest the line, so that in pulling up the line all the slack will occur between the line and the first insulator, thus making it unnecessary to pull the line more than 6 in. to uncouple the string from the line. The slack is pulled up with the regular tackle of treated rope and "come along" wire grips equipped for handling with a switch stick. Through one lever of the wire grip is looped a piece of tie wire so the grip will open when picked up on the end of a switch stick. To this loop is fastened the treated rope which, in turn, is threaded through a snatch block attached to a cross-arm. The wire grip is placed on the line conductor as far from the pole as can be conveniently reached with a switch stick. Two men are required to place and operate this tackle.

After the stress on the insulator has been relieved, it is unhooked from the line clamp with switch stick; the new insulator substituted, and the tackle released.

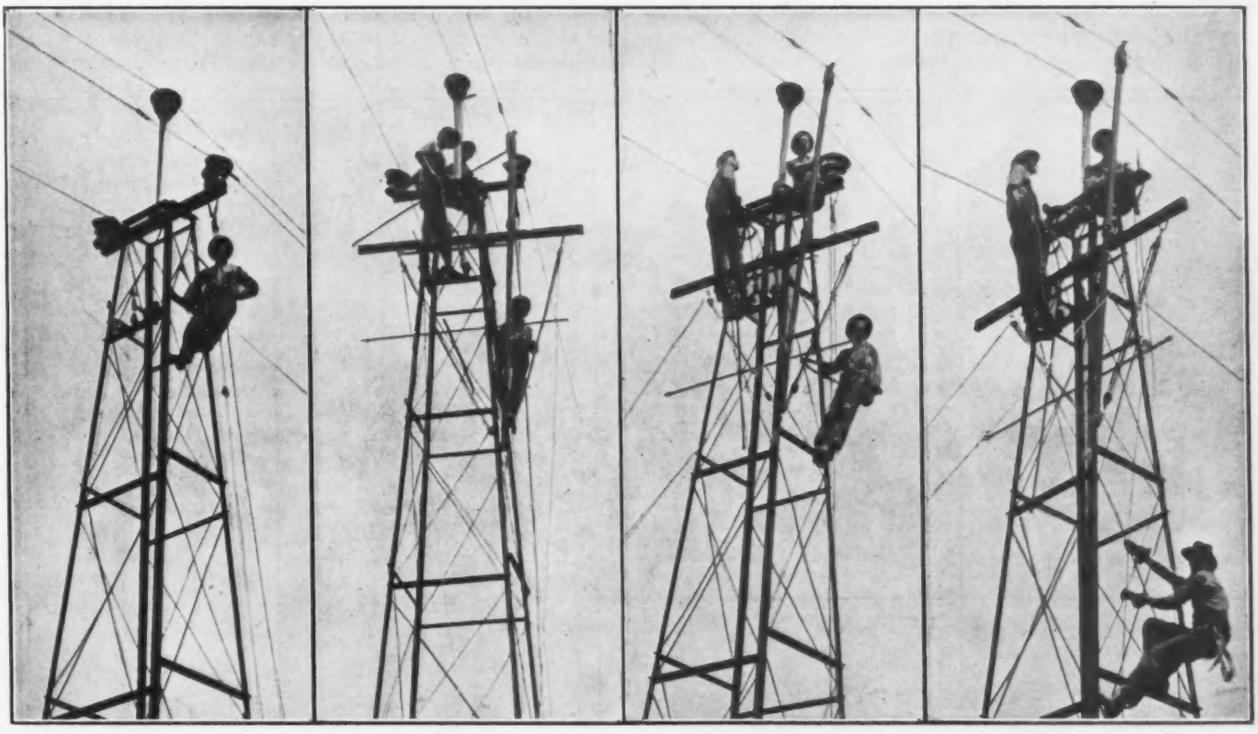


FIG. 2—FOUR STEPS IN THE CHANGING OF INSULATORS ON 50,000-VOLT TOWER LINE WITHOUT INTERRUPTING SERVICE

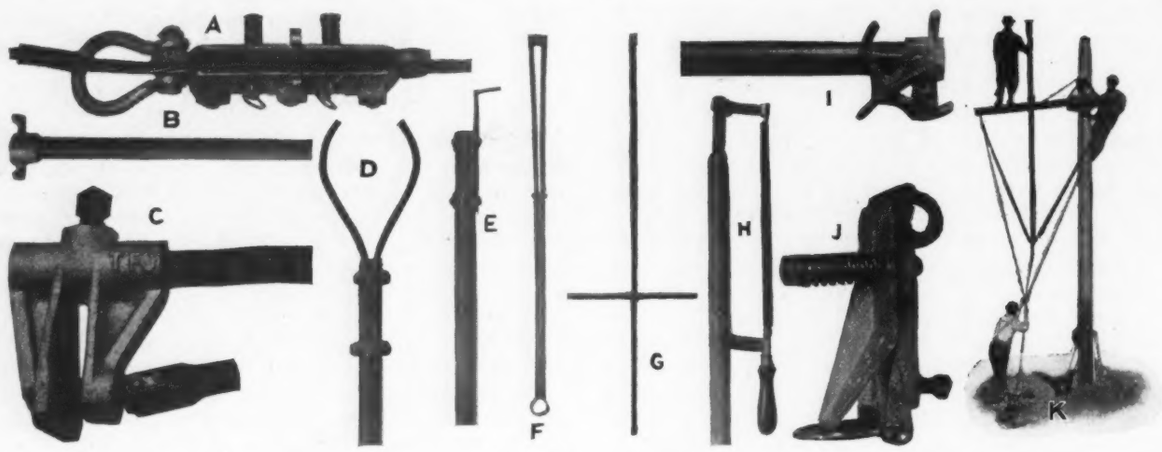


FIG. 3—SPECIAL TOOLS AND DEVICES USED WHEN WORKING ON LIVE HIGH-VOLTAGE LINES

A—Dead end or strain clamp used in live line work. *B*—Stick for use with line clamps, shown as *J*, for handling ropes, straightening wire, removing insulator tie wires, etc. *C*—Tower clamp used with Johnson line clamp on a jumper for grounding conductors on towers when working on dead lines with bare hands. *D*—Stick for handling suspension type insulators. *E*—Stick used to pull cotter keys. *F*—Tongs for holding live lines while being cut with hacksaw shown as *H*. *G*—Socket wrench for tightening bolts in strain clamps when used on live lines. *H*—Hacksaw mounted for live line work. *I*—Safety stick for use with line clamps and designed to prevent possibility of dropping the clamp when this would be serious. *J*—Johnson transmission line clamp. K—Johnson insulator changer for handling conductors operating at voltages from 40,000 to 110,000.

If the insulator has a ball-and-socket coupling, an insulated cotter key puller is used to withdraw the cotter key. A fork stick is serviceable in this operation, because it will fit snugly around the insulator cap. For double-strain construction two grips are used, the tackle being allowed to rest on the cross-arms, thus releasing the insulators on both sides at the same time. Side guys of treated rope can be used to advantage in equalizing side stresses.

Strain or dead-end clamps like the one shown in Fig. 3 are often useful in repair work as well as for permanent installations which have to be made on "live" lines because they can be snapped on a line conductor and slid to the desired clamping point with a switch stick. In this position the nuts can be screwed up with an insulated socket wrench, after which the springs may be removed by pulling the brass holding wires shown in the eyes of each spring pin. To dead end a line extra long eyebolts are employed, and insulators connected thereto by means of a forked stick, then the slack is taken up by screwing up the eyebolt nut.

REMOVING OLD CROSS-ARMS AND POLES AND SUBSTITUTING NEW ONES

To change a cross-arm without interrupting service requires the use of a paraffine-treated rope and a conductor lifter or prop supported by its own cross-arm. For this purpose new dry, hemp rope of any size desired is boiled in paraffine for twenty-five minutes and then cooled, care being taken not to allow the paraffine to overheat or the rope to burn by coming in contact with the vessel in which the paraffine is melted. A rope so treated will stand a flash-over voltage for any part of its length, nevertheless it should not be allowed to lie on the ground very long. When it becomes dirty it should be replaced by a new rope. The conductor-prop

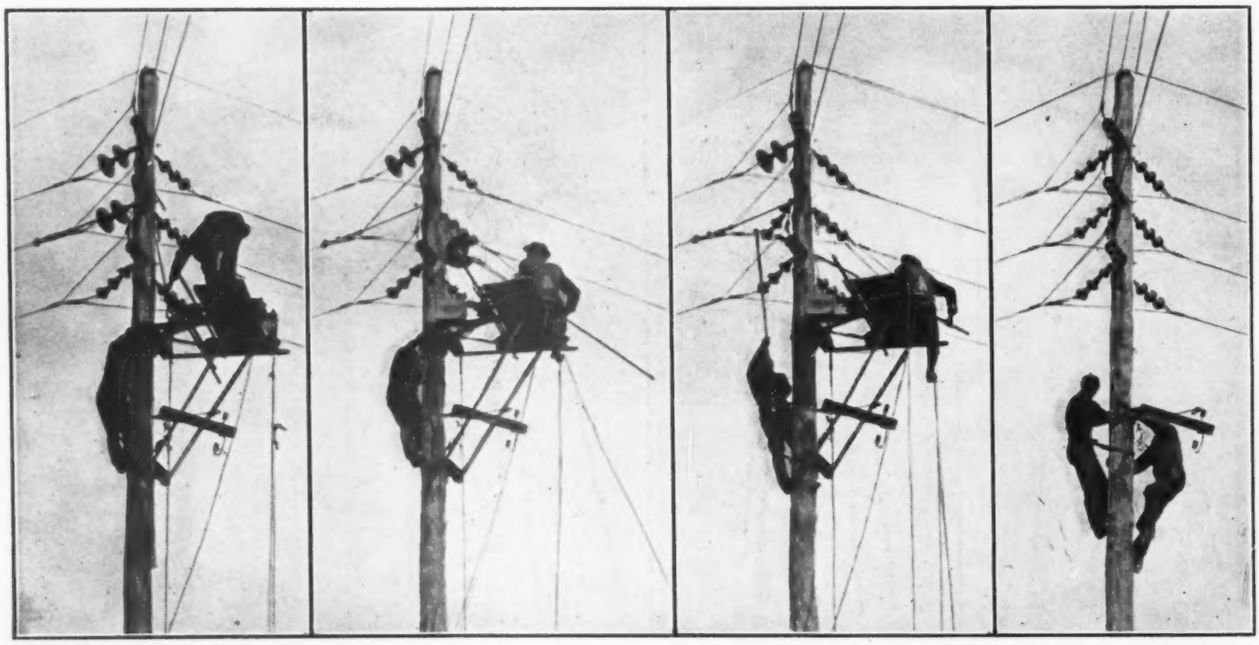


FIG. 4—METHOD OF REPLACING INSULATORS ON THREE-WAY STRAIN POLE OF 22,000-VOLT LINE WITHOUT INTERRUPTING SERVICE

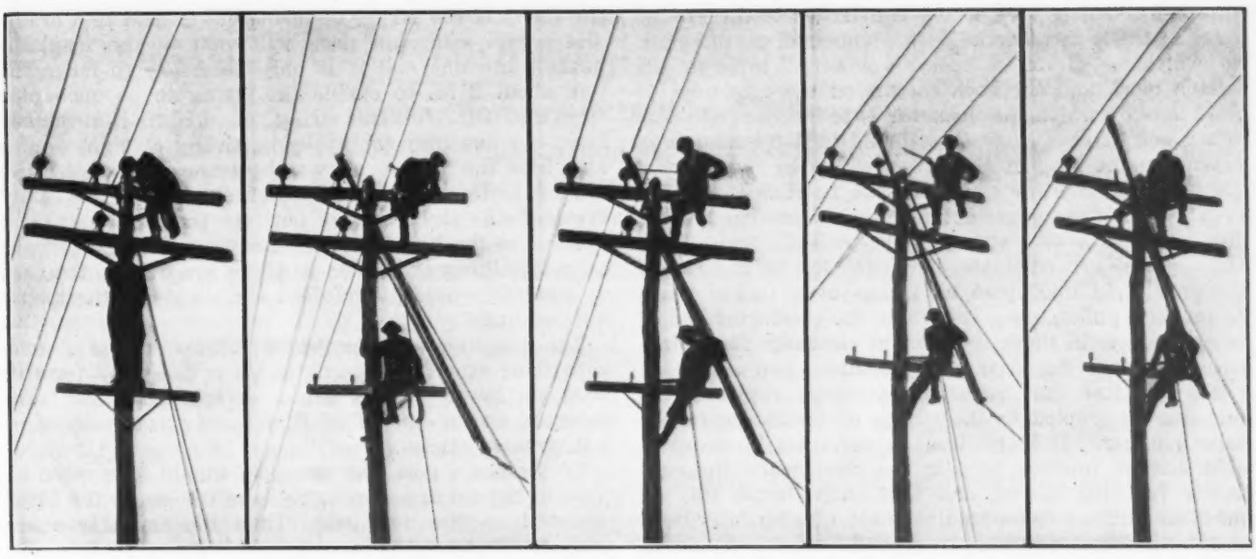


FIG. 5—FIVE STEPS IN THE CHANGING OF A PIN-TYPE INSULATOR ON A 11,000-VOLT POLE LINE

cross-arm is attached about 3 ft. below the cross-arm to be changed, but on the opposite side of the pole. Then, each conductor in turn is detached from its insulator as explained before, forced out of reach of the cross-arm and side guyed by a treated rope. The last to be removed, however, may be left propped out of reach in the lifting device. The treated rope is hooked to the conductors by means of switch sticks. The reverse process is employed in connecting the wires to the new cross-arm.

CHANGING SUSPENSION INSULATORS ON A LIVE 110,000-VOLT LINE OF EITHER WOOD-POLE OR STEEL-TOWER TYPE

The changing of a suspension-type insulator on 110,000-volt lines of the wood-pole type of construction, while under voltage, is essentially the same in all details as the changing of suspension insulators on wood-pole lines operating at lower voltages. A standard insulator changer such as already mentioned and shown as *K* in Fig. 3 is used for this purpose. The operation is exactly the same in both cases, except in the case of the higher voltages when clearances in proportion to the voltage must be allowed. The fact that the voltage is high must constantly be kept in mind, and common-sense precautions must be taken, such as, not working above a wire; not working in such a position that if an arc were started the wind would blow it toward the lineman; not working with damp tools, or in a rain or thunder storm, etc. All details in connection with this work have been fully described in connection with work on lower voltages.

In the case of tower lines—if the spans are not too long the insulator changer is also used, its limitations being mechanical ones only, such as the weight of conductor to be lifted. In the case of very long spans and heavy conductors, the insulator changer cannot be used to handle the conductors, but they can be handled entirely by means of treated rope, in very much the same way as they would be if the line were dead. The changing of a suspension insulator on a double-circuit 110,000-volt tower line will serve to illustrate the various steps of the method used at this voltage.

To make the change, a long treated line is passed

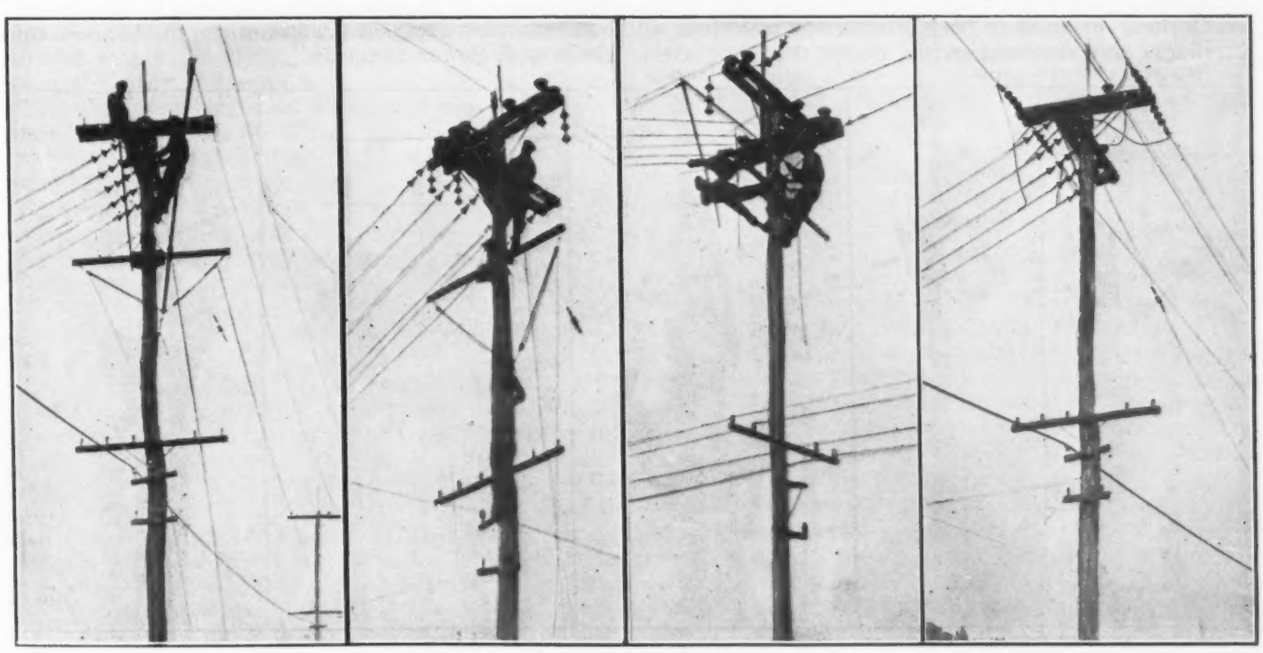


FIG. 6—STEPS IN THE PROCESS OF CUTTING IN METERING EQUIPMENT ON A 22,000-VOLT LINE

through a snatch block which is attached to the ground line. At the top of the tower one end of this line, to which is served a hook, is lowered through the snatch block and the hook caught on the conductor of the phase on which the insulator is to be changed. The other end of this same line should be long enough to extend to the base of the tower where by means of a set of blocks the line conductor can be raised and lowered. To this same conductor is hooked another treated line which acts as a side guy or "pull-off" line. With the ropes so arranged, the conductor can be raised and the insulators uncoupled by means of a forked stick, cotter key puller, etc., and then the conductor pulled to one side until there is sufficient clearance for a lineman to get to the string of insulators and make the change. After the insulators have been replaced, the line can be coupled to the string of insulators in the same manner. It is needless to say, that it is advisable that all linemen keep in the clear while the conductor is being moved, and that they should stay in the clear until all ropes holding the conductor have been tied, as it is not desirable to depend on the groundman to hold the ropes under heavy strain.

CHANGING A DEAD-END INSULATOR ON A 110,000-VOLT STEEL-TOWER LINE OR WOOD-POLE LINE

The process of changing a dead-end insulator on a 110,000-volt line while under voltage is exactly the same as changing a dead-end insulator on a lower voltage line, except that the strings of insulators are very much longer, and the treated pulling line cannot be pulled up as short or as close to a dead ground without running a serious risk of a flash-over. The most serious difficulty is encountered from the extreme length of a string of insulators due to the fact that as soon as a pull is made on the line the string of insulators sags and locks itself so that it is almost impossible to uncouple them. To overcome this, use is made of what is known as an insulator cradle. This cradle consists of two pieces of 2-in. by 4-in. treated timber with notches cut in them, the notches being so spaced that the edges of the insulator skirts will mesh with the notches. These timbers are tied together with short pieces of rope, making what is very similar in all appearances to a rope ladder. This cradle when lowered from above and put around a string of dead-end insulators will hold the string straight and rigid. The cradles may be made in lengths sufficient to include all insulators in a dead-end string, except the one nearest the line. If the string of insulators is held in a cradle and a pull made, all slack will come at the insulator nearest the line and it is only necessary to move the line about 2 in. to enable the string to be uncoupled from the line. After this string of insulators is uncoupled from the line they can easily be swung at right angles and into the tower, all weight being carried by the cradle. In this position the bad insulators can be easily replaced, the string swung out into position again, and coupled to the line. It is, of course, necessary to have as many different cradles as there are different makes of insulators used at the dead end points of the transmission lines.

The coupling and uncoupling of insulators is done with tools exactly the same as those described for live work on lower voltage lines, except that they are mounted on the end of 12-ft. treated sticks instead of 8-ft. treated sticks.

To replace a pole, the new pole should be erected as close to the old one as possible, and the conductor lifter mounted on the new pole. Then the conductors are propped or guyed at convenient distances from the pole, as explained before; the cross-arms on the old pole discarded or attached to the new pole, and the old pole taken down. The line conductors are then replaced exactly as before.

Numerous uses are made of spring clamps, such as connecting apparatus, tapping live lines, grounding to permit repairs, to serve as sectionalizing switches, etc. To disconnect a bank of transformers from their buses when connected thereto by spring clamps, a dry rope is stretched near the transformer leads between convenient points on the station framework. The clamps are then removed from the buses by a switch stick and snapped on the rope at safe distances apart. When metering equipment must be removed from service, the series circuits are shunted by jumpers having spring-clamp terminals and the meters separated from the leads by switch sticks. To permit repair to equipment connected in the ordinary way, the apparatus is shunted by jumpers with spring-clamp terminals and the apparatus leads severed with a highly insulated hack saw. Spring clamps are used to re-connect the repaired apparatus and permanent connections made later if desired.

The line lifter, clamps and special tools shown in the illustrations of this article were devised by T. F. Johnson, superintendent of transmission of the Georgia Railway & Power Company.

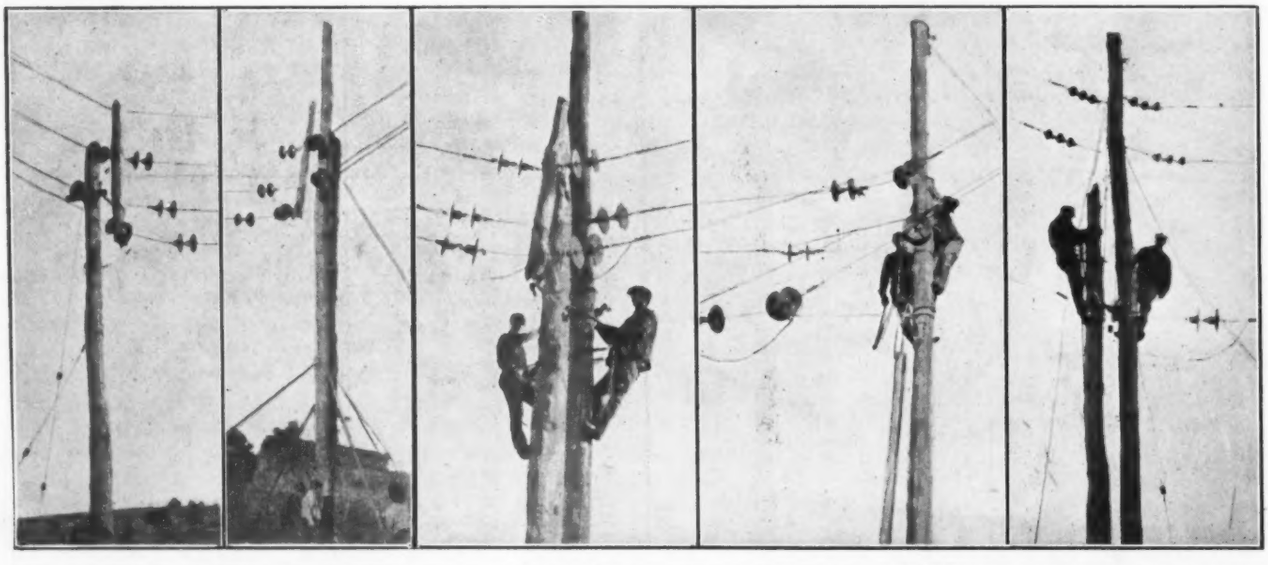


FIG. 7—METHOD OF REPLACING BROKEN CORNER POLE AND CHANGING INSULATORS ON A 22,000-VOLT LINE WHILE IN SERVICE

Lubrication of Station and Industrial Machinery—III

Suggestions in Regard to the Storage, Filtration and Recovery of Lubricating Oil that Tend to Improve Its Usefulness and Reduce Machine Maintenance Costs

BY DR. ARTHUR CURTIS SCOTT
Consulting Engineer, Dallas, Tex.

THE sections of this article which have appeared in the April 8 and May 12 issues of the ELECTRICAL WORLD have considered chiefly the matter of economic lubrication of machinery with respect to the design and characteristics of bearing surfaces, and the properties of suitable lubricants.

The responsibility for the economical operation of machinery, with respect to the lubrication thereof, has been largely placed upon the manufacturers of machinery and of lubricants in the interests of the operator. It must be recognized, however, that the operator cannot be relieved of definite responsibility in the economical use of lubricants, even though the machinery and the lubricants may be perfect in character. The operator must concern himself with the cleanliness, proper amount, and possible repetitions of use, of the lubricant as affecting the maintenance and economical operation of machinery under his care.

STORAGE OF OILS

As a first consideration the storage of oils deserves attention, quite as much for the smaller plants as for the large ones. In many small plants the oil is stored in pump cans, and impurities may be introduced in the transfer from barrels to storage cans, or the can covers may be left open permitting dust and grit to be blown into them and thus cause the oil to give trouble subsequently. In the filling of both large and small storage tanks from barrels, a fine wire gauze strainer should be so made and placed over the inlet to the tanks as to preclude any foreign substance from passing in with the oil, and should be readily removable for cleaning. To reduce the risk of grit entering the small cans which may be filled from a storage tank, the outlet of the tank should be provided also with a removable wire or, preferably, cotton gauze strainer.

The aim of these remarks is not to state anything new to the average operating engineer, but the writer considers them significant because he has witnessed trouble with hot bearings, which was attributed to the general quality of the oil used, when it appeared more likely that carelessness in the storing and handling of the oil was responsible for the trouble. In this connection also it may be observed that semi-solid and solid lubricants should always be stored in such manner as to preclude the admission of any grit that may fall or be blown in their vicinity. Moreover, in the use of graphite as a lubricant, care should be taken to see that no grit is present, as occurs in the natural product. Rubbing the graphite on the thumbnail will enable one to detect the presence of grit in perhaps the most sensitive way.

A word may be said here with reference to the storage of fuel oil. Steel tanks are common for the purpose, placed both above and under ground, and in more recent years reinforced concrete tanks have been found to be serviceable. In order to keep the temperature of the oil more uniform it is desirable to place steel tanks in the ground, but in many locations the acids in the soil corrode the steel exterior rapidly, thus rendering the tanks useless. About four years ago the writer replaced two such underground steel tanks with reinforced concrete ones. The latter have shown no evidence of leakage and appear to be permanent in character. It should be said, however, that these concrete tanks are underground, and it would appear at the present time that such tanks placed above ground can hardly be relied upon to give good service permanently. The writer has also supervised the construction of other concrete fuel-oil storage tanks, similarly placed in the ground, which are entirely satisfactory in service. The cost is less than for steel tanks, and the corrosive action of ground water carrying active salts is eliminated.

CLARIFICATION AND RECOVERY OF LUBRICATING OIL

Sections I and II of this article have evidenced the variety of lubricated bearing surfaces of machinery which must be dealt with in connection with use of oil and have endeavored to partially classify the service and to correlate with same the characteristics of lubricants.

Economical lubrication involves the repeated use of oil until its vitality as a lubricant shall have been practically exhausted. While there are several efficient types of clarification apparatus available at the present time, it appears that their use is not as universal as it should be, and in many cases their characteristics are not sufficiently understood to enable the operator to profit by the results possible through their installation.

All forms of settling and filtering apparatus have their limitations, because while they may efficiently remove carbon, metal dust, grit and other impurities collected by the oil which has passed over bearing surfaces, they do not indicate the change in viscosity, volatility and other characteristics of the oil as a lubricant, and hence the number of safe repetitions of use, and the difference in amount to be used in many cases of repetition, is not well defined among operators.

This feature is considered to be of great significance in the larger plants, where pipe feed is used with turbines and engines, and when an operator shall have a knowledge of the true characteristics of the new oil he is using, then might he profitably supplement his clarifying apparatus with a viscosimeter, and other simple physical and chemical apparatus to quickly test his clarified oil periodically and determine the per cent of useful life remaining in it for service.

The writer considers that the practice with some operators of adding a little new oil from time to time to the old which is being used over and over again, is a mistake, unless apparatus is in use to prove that the new oil mixes with the old in a uniform manner, for it is believed that cases are rare where such mixing shows proper homogeneity and ultimate economy. The prime consideration is to maintain the integrity of the bearing surfaces, over the longest possible time, and thereby reduce maintenance charges. The less he mixes his oils, as a general proposition, the less will it be necessary to learn facts about their serviceability.

As an illustration of what the writer considers to be good practice in this regard, the operating engineer of a medium-size steam-turbine plant, of about 16,000 kva. rating, pumps his turbine bearing oil over and over for a week, and then draws it off into a combined settling tank and filter. At the same time the turbine tank is refilled with filtered oil, and this practice is continued from week to week until the batch of oil is, in his judgment, unsafe to use. The oil is then taken from

the filter and used for auxiliary machinery in the plant. A new batch of oil is introduced into the turbine storage, and the filtering process is repeated. The chief suggestions that might be made with reference to all-around economy in the practice outlined are: First, some arrangement should be made to cool the oil coming from the turbine bearings before it is pumped over them again, as the temperature by theromometer runs about 170 deg. Fahr.; second, the use of a viscosimeter periodically, together with some supplementary testing equipment, might serve to prolong the period over which a batch of oil is now used on the turbines.

It is not considered desirable in this brief article to discuss the merits of oil clarification apparatus, but the writer believes that a prime requisite of any so-called "oil filter" is a capacious sedimentation tank, wherein the oil which was used once or oftener may have ample time to remain in a quiescent state until the heavier foreign particles shall have settled out by gravity. Then the upper and clearer portion should be filtered, without disturbing the lower strata, which will be fouled with sediment. Numerous filter materials are available such as excelsior, cotton waste, bone black, muslin, etc., but none of these materials will remove impurities of a certain class, when the attempt at rapid clarification is made, without previous sedimentation of the oil.

In this connection it may be remarked that the use of one of the high-grade filters by the writer, in connection with a forced-feed lubricating system on a large internal combustion engine, was quite unsatisfactory in the clarification of the oil, until supplemented with a home-made sedimentation tank, having three compartments, two of which were used for sedimentation alone, the first containing a readily removable and cleanable excelsior "pack." In this supplementary tank, provision was made for siphoning the top oil from one compartment to the bottom of the next following, and valve connections at the bottom for removing the sludge oil. The reason for the inefficiency of the standard filter alone to do the work is attributable to the fact that too much carbon-surcharged oil was run through it in a given time. The filter material did not remove the carbon, and the oil was about as black when it left the filter as when it entered it. The supplementary tank afforded the necessary time required to allow the carbon to settle out and produce satisfactory results. It may be noted also that no water was used in this clarification apparatus. This fact is referred to here because it is presumed by some that water is a necessary factor in such purification of oil. Unless the water be charged with certain chemical ingredients, and agitated with the oil, and then the mass allowed to separate, in which process may be involved the factors of reaction and precipitation, as well as sedimentation, the writer has never been able to discover any advantage in the use of water in a clarification apparatus. A very dirty oil, when poured into water, will invariably rise to the top without leaving behind any of its impurities. The surface tension of the oil film of the globules is quite sufficient to withhold the fine, heavier-than-water impurities within them indefinitely, in the presence of no greater agitation than that of merely pouring the oil into the water.

With reference to the use of filters in small power-plant work, it should be said that, as such filters are commonly constructed, the practice of collecting the drips from pans and pouring same into the filter at all times of day or night, whenever it is convenient, is most detrimental to the possible purification of the oil. Every time a batch is poured in the previous ones will be stirred up more or less, and the normal process of sedimentation interfered with. Much better results will be obtained ordinarily by collecting the drips in a receptacle and emptying this oil into the filter once a day, or, in general, at such times as to leave the oil in the filter entirely quiescent over as many hours as possible, commensurate with the capacity of the filter and the amount of oil to be reused.

The writer is not unaware of the fact that the continuous system of clarification of oil is comparable in efficiency with the intermittent system under certain conditions, but with either system the economical results sought will be obtained most readily by the use of reasonably capacious sedimentation tanks, which allow a considerable period of time for gravity to slowly act in separating the foreign matter from the oil.

A pipe feed system layout including oil clarification apparatus the writer considers decidedly beneficial and economical in many small plants, where the splash and ring oiling apparatus are in use. A simple system of stream feed lubrication, with proper facilities for the clarification of the oil, will prolong the life of the machinery, reduce the maintenance costs, and pay large interest on the investment, when compared with the too common practice of using dirty oil almost continuously. To change present splash and ring oiling systems may necessitate the placing of oil guards, stream feed cups, small pumps, etc., but the use of clean oil in relatively large quantity over and over again with stream feed, can readily be shown to amply justify such changes and additions as may be necessary in the majority of plants.

In large plants involving matters of both high speed and high temperature lubrication, provision should be made in the interest of the durability of the bearing surfaces, to cool the oil, but entirely independently of the clarification apparatus, however, as heat augments the sedimentation process of clarification. Moreover, large power plants in general should find extensive use for the viscosimeter, and testing equipment for volatility and carbon content of lubricating oils, in the interests of economy in maintenance of machinery particularly as well as in reduced consumption of lubricating oil.

Conservation Congress Indorses Naval Consulting Board

The Sixth National Conservation Congress which recently held its annual meeting at Washington passed the following resolutions in support of the nation-wide work, with an organization of more than 30,000 trained engineers, of the committee on industrial preparedness of the Naval Consulting Board of the United States:

Whereas, The present war in Europe has shown that national defense in this age is secured not only by armed men, but by organized industries, and

Whereas, The committee on industrial preparedness of the Naval Consulting Board of the United States is engaged in organizing the industrial resources of this country for public service in national defense, and

Whereas, At the request of the President of the United States, the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Chemical Society are actively co-operating with the committee on industrial preparedness in this work; therefore,

Be It Resolved, That we heartily indorse and pledge our support to the patriotic work of the engineers and the committee on industrial preparedness of the Naval Consulting Board of the United States and commend their able and patriotic work.

Installation Costs for Industrial Plant Substations

Construction and Operation Features, Detailed Costs, Service Requirements and Revenue for Small Out-door Substations Serving Southern Industrial Plants

BY N. NESBITT TEAGUE

SMALL outdoor substations are rapidly finding a more and more extensive application in both large and small transmission systems on account of the economic engineering which they make possible in serving small loads. Through the data and brief descriptions which follow the writer has endeavored to show some interesting examples of a successful supply of power by the use of this type of station; the cost of construction for the stations and extensions thereto; the operating and load conditions; the extent and nature of the demand and the equipment operated.

These stations are operated on a 13,000-volt, three-phase, 60-cycle, isolated delta distribution network located in the South, and serve industrial plants such as cotton mills, cotton oil mills, kaolin mines, silk mills, chemical and fertilizer works, etc. Twenty-four hour service is required and interruptions to this service would cause an inestimable loss to, say, the cotton mill, where hundreds of operatives would be idle, or to the brick yard, where hundreds of bricks would be burned if the blowers were idle. Such concerns as this, whose old steam-engine advocates are yet dubious of central station service, must be pleased if the company is to hold its present customers and obtain other similar loads in this locality. Typical contracts are cited to show the nature of the agreements of the company with its consumer, and the losses and penalties for service interruptions.

The following is a contract with a cotton mill served by the substation referred to in Table X.

SECONDARY POWER CONTRACT FOR ELECTRICAL ENERGY

Agreement entered into this.....day of ....., 191.., between the ..... company, hereinafter called the "company," and the ..... Manufacturing Company, hereinafter called the "customer."

Witnesseth:—For and in consideration of the mutual covenants and agreements hereinafter contained, the parties hereto agree with each other as follows:

(1) The company agrees to furnish to the customer, and the customer agrees to take from company (except when prevented by causes beyond the control of either party), for and during a period of five years beginning ....., or as soon as the company shall be able to deliver energy to the customer, and a complete connection is made between the transmission lines of the company and the completely installed electrical apparatus of the customer, which shall not be later than.....all electrical energy hereinafter defined as secondary power, in the form of three-phase alternating current at a pressure of approximately 13,000 volts, and at a normal frequency of 60 cycles per second with allowable variation of three (3%) per cent above or below normal, that shall be required by the customer for the operation of its cotton mills located at ..... to the extent and for the operation of a maximum demand of 625 hp.

(2) By "secondary power" is meant such energy as the company agrees to furnish and supply eight months out of each consecutive twelve months period of this agreement, and is such energy as the company reserves to itself the right to shut off and discontinue the supply thereof, by giving the customer twenty-four hours' notice of its intention to discontinue the supply, and being such energy as the customer agrees to resume the use of within twenty-four hours after the receipt by it of notice from the company that the company is ready to supply and furnish said energy to the customer, provided that the company shall not shut off and discontinue such supply during an aggregate period of more than four (4) months in each consecutive twelve (12) month period of this agreement.

(3) The customer shall pay to the company one ($1) dollar per month for each horsepower of maximum demand recorded by the instruments of the company, for all energy used between the hours of 6.30 a. m. and 6.30 p. m., and one ($1) dollar per month for each horsepower of maximum demand used between the hours of 6.30 p. m. and 6.30 a. m. The customer shall, however, have the option of paying for electrical energy used between the hours of 6.30 p. m. and 6.30 a. m., on any working day, or at any time on any Sunday at the rate of one and one-half cents (1.5 cents) per kilowatt-hour. The customer shall have the right to use electrical energy from 6.30 a. m. to 6.30 p. m. on any Sunday, for the purpose of repairs to any of its machinery, apparatus or buildings without extra charge.

The customer agrees, however, that the aggregate amount of such monthly bills shall not be less than the sum of three thousand seven hundred and fifty dollars ($3,750) per year, which shall be termed the "minimum charge."

Should the company fail to supply energy to the customer during the full period of a month as hereinafter defined in section four the charges of one dollar ($1) per month shall be reduced proportionately.

(4) A period of a day as used in this agreement shall be understood to commence at 6.30 a. m. and end at 6.30 a. m., twenty-four hours later, and a period of a month shall be considered as the days in the particular calendar month less Sundays. A horsepower shall be considered as the equivalent of 746 watts.

(5) The maximum demand shall be measured by the company on the primary side of the service transformers at a pressure of approximately 13,000 volts by such graphic recording meters as the company may install at its expense on the premises of the customer in a suitable place or building provided by the customer; and shall be considered as the maximum rate of use of the electrical energy enduring through any ten-minute period except that any maximum demand occurring on any Monday morning before 12 o'clock noon, shall not be considered. The electrical energy shall be considered as delivered at the point of measurement. Peaks due to short-circuit or accidents to the apparatus of either party to be disregarded.

(6) It is distinctly understood and agreed that in the event the maximum demand exceeds that provided in the first clause, the minimum charge as provided in the third clause shall increase in the same ratio as such increase bears to such demand.

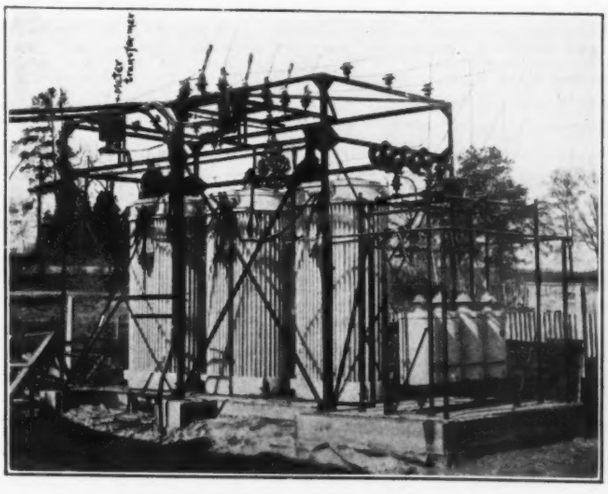


FIG. 1—A 900-KVA. SUBSTATION THAT SERVES A COTTON SEED OIL MILL

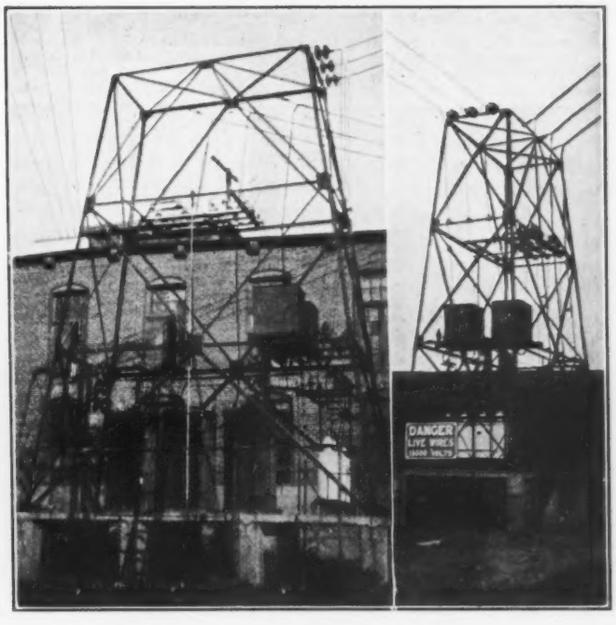


FIG. 2—A 750-KVA. SUBSTATION INSTALLED AT A COTTON BAGGING AND WASTE MILL

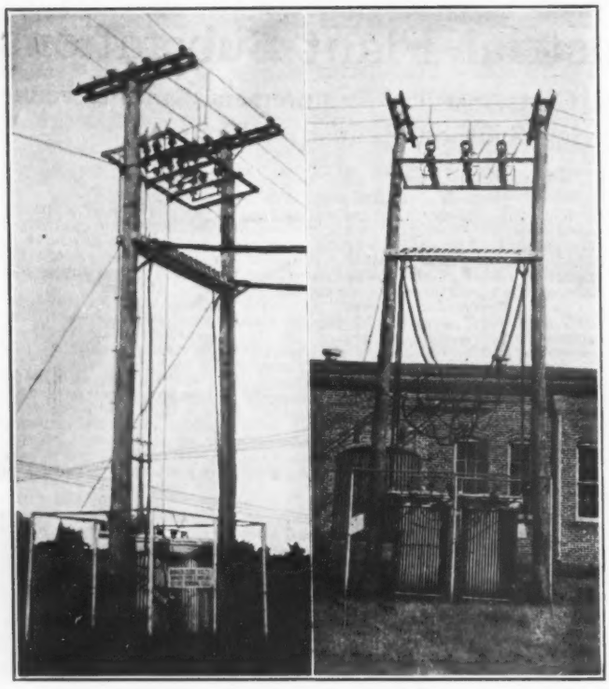


FIG. 3—A 300-KVA. SUBSTATION INSTALLED AT PLANT OF AUTO TIRE MANUFACTURER

(7) The customer agrees to pay all bills due the company within ten days after rendered, at the company's office in the city of ..... If the customer shall at any time be in default of payment for more than ten days the company shall have the right to suspend the delivery of electrical energy after having given the customer ten days' notice in writing of its intention to do so. By suspending the delivery of energy for such cause the company forfeits none of its legal rights. If the customer shall at any time be in default for thirty (30) days, the company may declare this agreement void, by giving written notice of its desire to do so. Such termination shall not relieve the customer of its liability to the company, and the customer shall pay to the company as liquidating damages, but not as a penalty, the sum which should have accrued on the basis of the minimum charge in the unexpired portion of the term of this agreement.

(8) It is distinctly understood and agreed that the electrical energy to be supplied hereunder shall not be resold or used for light except in the buildings, stores, halls, churches, schools and mill tenements owned by the customer on premises where said energy is used for power purposes or the lighting of the streets of the mill village of the customer; nor by any other firm, person or corporation than the customer, nor by the customer, except upon the premises and for the purposes herein specified.

(9) The customer may increase the maximum demand by giving notice to the company six (6) months in advance of the time said increase shall go into effect. The company, however, will not reserve any power except as herein specified for the use of the customer and will not increase the amount it shall deliver to the customer if it does not have the capacity available.

In consideration of the right to increase the maximum demand and provided the company is ready and able to supply the customer all the electrical energy it may require during the life of this agreement or any renewal period thereof the customer agrees not to use any electrical energy other than that furnished by the company except such as may be generated by the customer.

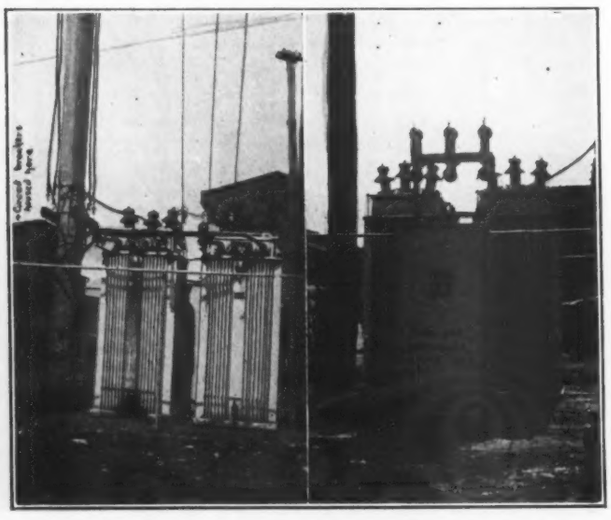


FIG. 4—A 600-KVA. SUBSTATION INSTALLED AT A FERTILIZER PLANT AND OIL MILL

(10) Customer shall have the right to renew this agreement for a further period of five years under the same terms and conditions as this agreement in all respects, except as to the right to change from secondary to primary power as provided in section eleven hereof, by giving the company written notice of its intention to so renew, one year previous to the expiration of the first five-year period.

(11) The customer is to have the right at any time within the five years from the time this agreement goes into effect but not thereafter to change the service herein contracted for from secondary to primary power, in which case the customer agrees to pay the rate of one dollar and fifty cents ($1.50) per month per horsepower, measurement and delivery to be as provided in the fifth clause.

(12) It is understood and agreed that should the customer change this agreement or provide for the use of primary power, then and in that event the minimum charge as provided in the third and sixth clauses shall increase in the same proportion as one dollar and fifty cents bears to one dollar.

(13) All meters and other appliances and equipment, which may be at any time installed in the customer's premises at the company's expense, shall remain the property of the company. (It is understood and agreed that the company will bear the expense of necessary repairs not occasioned by the negligence or acts of the customer or its employees, to the service transformers owned by and located on the premises of the customer, provided such transformers are operated in accordance with the reasonable rules and regulations of the company.)

(14) All meters shall be tested and calibrated from time to time at the option of the company, or at the request of the consumer. Any meter tested and found not to be more than two (2%) per cent in error shall be considered as correct and accurate. If any meter shall be found to register more than two (2%) per cent in error, proper proportionate correction shall be made in the bill for the electrical energy extending back to the prior test, but in no event shall such correction extend back beyond thirty (30) days previous to the date on which such inaccuracy shall be discovered by such test.

(15) It is further understood and agreed that the customer hereby grants and conveys to the company the rights of ingress and egress and the right to erect poles and accessories, string its wire across or over the customer's property for the purpose of connecting to the company's service the customer's electrical installation at the point of delivery, and the removal of its poles, wires, accessories and other electrical equipment, this right to remain in full force and effect during the term of this agreement or any renewal period thereof and a reasonable time thereafter.

(16) Any question in dispute under this agreement shall be submitted to three arbitrators, one to be chosen by each party, and the third to be selected by the arbitrators thus chosen.

The decision of the majority shall be binding and conclusive upon the parties hereto.

(17) This contract is executed in duplicate and shall enure to and be binding upon the successors and assigns of the respective parties hereto.

IN WITNESS HEREOF: The parties have caused this contract to be executed by their duly authorized officers the day and year first above written.

ATTEST: SIGNED:

POWER CONTRACT FOR ELECTRICAL ENERGY

In the event of the customer taking "primary power" the contract differs from the above somewhat as follows: (This particular contract is for service to a silk mill, data for which are given in Table IX.)

The electrical energy to be furnished under this agreement shall be "primary power," provided, however, that whenever the maximum demand as hereinafter defined shall reach 200 hp., the customer shall have the option to call for "primary power" instead of "secondary power." By "primary power" is meant such energy as the company agrees to furnish and supply every day in the year between the hours of 6 a. m. and 6 p. m. (except when prevented by the causes specified in section sixteen hereof). Nothing herein shall, however, require the customer to take electrical energy from the company exceeding a maximum demand of fifty (50) horsepower, unless or until the customer shall elect to take a maximum demand of two hundred (200) horsepower of secondary or primary power as hereinafter provided.

Until the customer shall elect to take a maximum demand of two hundred (200) horsepower of secondary or primary power, the customer agrees to pay the company for electrical energy taken each month hereunder as follows:

(a) At the rate of twenty-five ($25) dollars per year for each horsepower of maximum demand theretofore recorded by the instruments of the company between the hours of 6 a. m. and 6 p. m. of each day; and in addition thereto:

(b) At the rate of twenty-five ($25) dollars per year for each horsepower of maximum demand theretofore recorded by the instruments of the company between the hours of 6 p. m. and 6 a. m. of each day, provided, however, that the customer shall only be required to pay under this paragraph (b) the proportion of such monthly charge as the number of days in the month during which electrical energy shall be taken by the customer between the hours of 6 p. m. and 6 a. m. shall bear to the number of days in the month.

The customer agrees that the aggregate amount of payments for each year shall not be less than the sum of ..... dollars, hereinafter the minimum charge.

Should the company fail to supply the energy during the full period of a month, then in that event the charge per horsepower per month shall be prorated on the basis of the number of days in the month in which the energy was supplied and furnished by the company.

The following clause is part of the service contract to a cotton bagging and waste mill from the substation shown in Fig. 2:

The company agrees that in case the delivery of energy to the customer shall be interrupted at any time or times between the hours of 6.30 a. m. and 6.30 p. m. for a longer period than five (5)

consecutive minutes, for causes other than those specified in contract, the customer shall be entitled to payment by the company of:

0.25 cent per minute for the first hour of such interruption.
0.15 cent per minute for the second hour of such interruption.
0.083 cent per minute for the third and each succeeding hour.

A maximum demand shall be the average of daily maximum half hour demands for the working day in each month, and shall be measured by the company on the primary side of the service transformers, etc.

LINE CONSTRUCTION

The species of poles used in all line construction is chestnut, classes "A" and "B," that conform to standard N. E. L. A. specifications. Georgia pine six-pin cross-arms are used after a treatment in hot creosote. Locust pins carry O. B. and Thomas insulators. The three wires are carried on the pole and end pins. The overhead ground wire has not been used universally and extensions are usually made without this feature. Bayonets grounded on each pole are used in some instances to protect the pole from lightning. Disconnecting switches have been used freely in order that various sections may be cut off and trouble localized, without causing lengthy interruptions to other customers on the line or lines.

The method of operating this system takes into account the distribution of the load, and means are provided for more than one source of power to all customers wherever possible.

SUBSTATION CONSTRUCTION

The small out-door substations that have been installed may be constructed very economically and efficiently by using one or more poles and locating the transformers at their base. It has been found advisable to locate the transformers near the ground, instead of raising them on platforms of steel framework, since they are easily removed if necessary, much more accessible for repairs, or to obtain oil for tests, or to filter and dry out should the oil require it. A neat fence is usually built for safety protection, inclosing the installation. With this arrangement the installation will be just as safe as if the transformers were raised some 10 or 15 ft. from the ground.

When the transformers are not too heavy, and the installation does not warrant the cost of a concrete foundation, a couple of old iron rails imbedded in the earth serve the purpose very well. Where the transformers are large and heavy, steel tower structures with concrete bases, or steel frame bases, are installed, but the units are not raised more than 1 ft. off the ground.

SWITCHES, FUSES, ARRESTERS AND METERS

The switches and fuses used on these stations are Burke horn gap, General Electric types D-7 and LG-9 and Delta Star designs. Due to the high cost of replacing the chemically filled fuses, home-made horn type fuses have been placed on this equipment, and in some instances these fuses have been placed directly on top of the transformers (see Fig. 6) so that they are accessible to renewal. The switches are arranged to operate from this location. Aluminum, copper, etc., string fuses are tested before they are installed.

Lightning is the cause of the most serious operating troubles in this locality, therefore the selection of the proper arrester is vital. Lines and stations have been equipped with designs other than the electrolytic aluminum cell type, but, of course, it is doubtful if the desired result of protecting electrical equipment from surges or the lightning menace has been accomplished. It is hoped that the installation of reactors, in some cases, between outside lines and the equipment, to drain off the surge through horn gaps to ground, has minimized the damage to transformers and inside apparatus; however, they do not offer full protection to line insulators nor take care of high frequency.

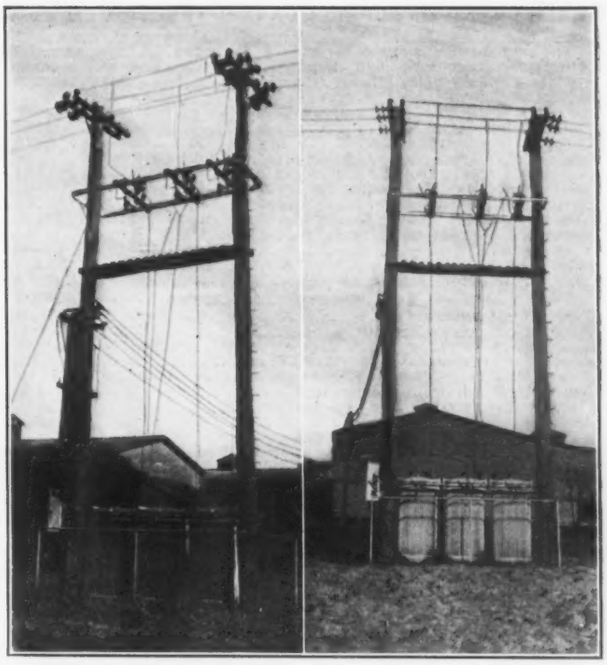


FIG. 5—A 450-KVA. OUTDOOR SUBSTATION INSTALLATION AT A COTTON OIL MILL AND GIN

The aluminum cell type of arrester has met the demand most desirably and has been installed whenever the installation warrants its cost and especially at the end of the lines. In Fig. 4 an installation is shown operating without trouble without arresters. They are near the central station or other aluminum cell arresters.

The meters are usually located directly on the installation or in an adjacent building. The metering has been performed on the primary side, or the secondary side of the installation, according to conditions or the desires of the customer. In general when metering on the 13,000-volt side, the potential and current transformers are housed in special boxes and the meter placed in the same box on the pole adjacent to transformers or near them. In Figs. 4 and 8 a home-made steel box arranged to house this equipment is shown. The meter is mounted so as to be accessible for test and easily read through a glass in the front door. In Figs. 5 and 6 the meter is shown installed on the pole where the metering is done from the secondary side.

Westinghouse and General Electric polyphase watthour meters are used to record the kilowatt-hour consumption, and where required, maximum demand or graphic recording wattmeters are used.

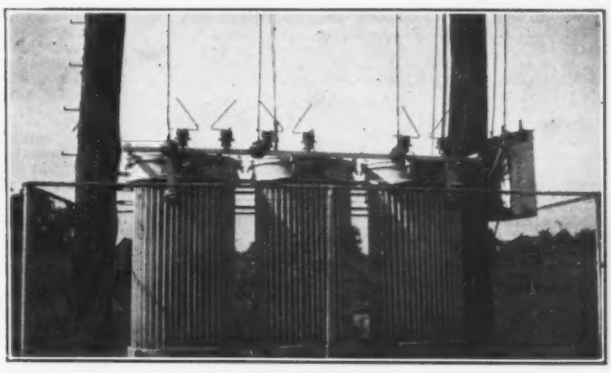


FIG. 6—ARRANGEMENT OF TRANSFORMERS FOR INSTALLATION SHOWN IN FIG. 5

TABLE I—COST OF SUBSTATION CONSTRUCTION TO SERVE A COTTON SEED OIL MILL

The substation shown in Fig. 1 is rated as 900 kva. The primary voltage is 13,000, 3 phase, 60 cycle, and the secondary 440 volts. This installation is located 25 ft. from the main distribution line.

COST ITEMS

Foundations	$105.00
Three 300-kva. transformers (G. E.)	2,416.00
One set G. E. type LG-9, 300-amp. 22,000-volt switches	110.38
One set G. E. electrolytic aluminum cell arresters	321.75
Steel framework, complete	91.00
Hardware, material, etc	105.32
Labor	180.77
Meter and current transformers	95.00
Total cost of substation	$3,425.27
Cost per kilovolt-ampere	3.80

CONTRACT DATA

Duration of contract	Five years
Horsepower contracted for	1200 to 1500
Hours of service	Twenty-four
Months of service	Eight
Service charge per kilowatt-hour used	6.6 mills
Guaranteed minimum per year	$6,000
Kilowatt-hours consumed per month	289,900
Gross revenue per month	$1,913

The installation serves a cotton seed oil mill and cotton seed feed mills. The following is the motor equipment: Three 150-hp. General Electric slip ring form M; three 150-hp. Westinghouse form HF.; and two 50-hp. General Electric squirrel cage form K motors. It is understood that the customer has the privilege of canceling the contract at the end of two years by giving ninety days' notice and the payment of $1,000 as liquidating damages, but not as a penalty. Under the same conditions the contract may be terminated at the end of three years by the payment of $800, and at the end of four years by the payment of $300.

TABLE II—COST OF SUBSTATION CONSTRUCTION TO SERVE A CHEMICAL FERTILIZER WORKS

The installation in Fig. 2 is rated at 200 kva. The primary voltage is 13,000, three-phase, 60 cycles; secondary 220 volts, two-phase. The substation is located 4800 ft. from the main distribution line.

SUBSTATION COSTS

Two 100-kva. General Electric transformers, one Westinghouse meter, Delta Star switches and fuses	$1,500.00
Poles, cross-arms, insulators and hardware	37.56
One set General Electric electrolytic aluminum cell arresters	365.50
Copper for bus	12.50
Fence and miscellaneous	50.00
Labor	90.00
Total cost of substation	$2,054.56
Total cost of extension	$960.01
Total cost of extension plus substation	3,014.57
Cost per kilovolt-ampere (extension plus substation)	15.00
Cost per kilovolt-ampere (substation only)	10.00

CONTRACT DATA

Duration of contract	Five years
Horsepower contracted for,	250 aggregate normal rated capacity in motors
Hours of service	Twenty-four for eight months
Service charge per kilowatt-hour used	11.0 mills
Guaranteed minimum payment	$1,500.00
Actual kilowatt-hours consumed per annum	173,300

Power is used for the manufacture of fertilizer. The following motors are operated: One 150-hp. General Electric form P slip-ring; one 35, two 25 and three 5-hp. General Electric form K squirrel cage. Transformers are Scott connected.

TABLE III—COST OF SUBSTATION CONSTRUCTION TO SERVE A COTTON BAGGING AND WASTE MILL

The installation in Fig. 3 is rated as 750 kva. The primary voltage is 13,000, three-phase, 60-cycle; secondary 550 volts, three-phase.

COST OF EXTENSION

One Westinghouse polyphase meter; one curve drawing wattmeter and equipment	$450.00
Nine disconnecting switches	99.00
No. 4 H. D. copper, guys and strains	98.25
R. C. wire	100.00
Poles, cross-arms, insulators and hardware	98.00
Conduit	93.50
Labor	160.00
Total cost of extension	$1,098.75

CONTRACT DATA

Duration of contract	Five years
Horsepower contracted for	970 maximum
Hours of service	Twenty-four for twelve months
Service charge per horsepower per month	$1.25
Guaranteed minimum payment	$2,750 yearly

The customer furnished the substation, transformers and all such equipment. The contract is for secondary power to be used as follows: In the bagging mill by one 200-hp. General Electric synchronous motor; four 35-hp. and two 50-hp. General Electric squirrel cage motors; in the waste mill by one 100, one 75, two 50, two 35, and two 5-hp. General Electric squirrel cage induction motors, and five 20, one 15, and two 35-hp. General Electric squirrel cage induction motors used on hoists and miscellaneous apparatus. The meter is placed in superintendent's office, some 400 ft. from installation.

TABLE IV—COST OF SUBSTATION CONSTRUCTION TO SERVE A FERTILIZER PLANT AND OIL MILL

The installation in Fig. 4 is rated at 600 kva. The primary voltage is 13,000, three-phase, 60-cycle; secondary 220 volts, two-phase. The substation is located 400 ft. from the main distribution line.

SUBSTATION COSTS

Two 300-kva. Westinghouse transformers	$1,700.50
Three General Electric type D7 fuses and switches	56.70
Poles, insulators, cross-arms and hardware	43.00
Copper for bus	88.78
Meter and equipment	312.60
Meter house	37.40
Fence	25.00
Labor	67.00
Total cost of substation	$2,330.98
Cost of extension	$258.00
Cost per kilovolt-ampere, extension plus substation	4.31
Cost per kilovolt-ampere, substation only	3.88

CONTRACT DATA

Duration of contract	Five years
Horsepower contracted for,	200 on basis of 475. This basis to increase in same proportion as motor installation increases.
Hours of service	Twenty-four for eight months minimum
Service charge per horsepower per month	$0.75
Additional charge per kilowatt-hour used	5.0 mills
Guaranteed minimum payment	$1,800
Gross revenue from September to February past	$4,364

The transformers are Scott connected and furnish power for the following motors: One 100, one 150, one 60-hp. General Electric slip-ring form M motors used in the press and linter rooms. Two 50-hp. General Electric squirrel cage form K motors in the cake mill. The following General Electric squirrel cage form K motors; one 35 on an elevator, one 5 in shop, one 10 and one 15 in fertilizer plant and two 150-hp. slip-ring to be installed on liters. The above rates apply during the customer's operating season. Electric energy used after the close of the regular operating season or during the period known as the dormant period, shall be paid for at the company's regular retail rates. During the operating season current used for lighting shall be billed under this contract; during dormant period to be paid at the company's regular lighting rates.

TABLE V—COST OF SUBSTATION CONSTRUCTION TO SERVE A COTTON OIL MILL

The installation shown in Fig. 5 is rated at 300 kva. The primary voltage is 13,000, 60 cycle, three-phase; secondary, 220 volts, three-phase. The installation is located 2450 ft. from the main distribution line.

COST ITEMS

Three 100-kva. Westinghouse transformers	$1,350.00
Three 15,000-volt, 30-amp. General Electric type D7 switches and fuses	56.10
Poles, insulators, cross-arms and hardware	35.90
Copper for bus	14.48
Watt-hour meter and equipment	120.00
Labor	45.00
Fence, paint and miscellaneous	40.40
Total cost of substation	$1,662.48
Total cost of extension	875.52
Total cost of extension plus substation	$2,538.00
Cost per kilovolt-ampere (extension plus substation)	8.46
Cost per kilovolt-ampere (substation only)	5.54

CONTRACT DATA

Duration of contract	Two years
Horsepower contracted for	350
Hours of service	Twenty-four for eight months
Service charge per kilowatt-hour	8.8 mills
Guaranteed minimum payment	$1,350.00
Gross revenue per eight months	4,992.00

The above rates apply during customer's operating season, the customer being allowed to disconnect service, and no charge being made during the shutdown or dormant period. The power is used for cotton-seed houses and oil mill. The plant operates the following motors: One 100 and one 150-hp. slip-ring General Electric form M; one 10, one 75 and three 50-hp. squirrel cage General Electric form K, and two 50-hp. slip-ring form M Wagner motors.

TABLE VI—COST OF SUBSTATION CONSTRUCTION TO SERVE A PNEUMATIC AUTO TIRE MANUFACTURER

The installation in Fig. 6 is rated at 300 kva. The primary voltage is 13,000, three-phase, 60 cycles; secondary, 220 volts, two-phase. The substation is located 4000 ft. from the main distribution line.

SUBSTATION COSTS

Two 150 General Electric transformers and Westinghouse meter	$1,350.00
One set Delta Star fuse switches and arresters	160.00
Disconnects rack and copper for bus	86.00
Meter box	35.00
Poles, cross-arms, insulators and hardware	21.00
Fence and miscellaneous	30.00
Labor	648.00
Total cost of substation	$1,730.00
Total cost of extension	1,366.00
Total cost of extension plus substation	$3,096 60
Cost per kilovolt-ampere (extension plus substation)	10.30
Cost per kilovolt-ampere (substation only)	5.76

CONTRACT DATA

Duration of contract	Five years
Horsepower contracted for	200
Hours of service	Twenty-four for twelve months in 1915
Service charge for horsepower per annum	$9.00
Additional charge per kilowatt-hour used	1.0 cent
Guaranteed minimum payment	$150 per month
Actual kilowatt-hour consumed per annum	138,596
Gross revenue per annum	$2,132.00

The transformers are Scott connected, furnishing power for the following motors: One 150, one 75, one 35 and five 5-hp. Westinghouse slip-ring and two 7½-hp. GE squirrel-cage motors.

TABLE VII—COST OF SUBSTATION CONSTRUCTION TO SERVE A COTTON OIL MILL AND GIN

The installation in Figs. 7 and 8 is rated at 450 kva. The primary voltage is 13,000, three-phase, 60 cycles; secondary, 550 volts, three-phase. This substation is located 6500 ft. from the main distribution line.

SUBSTATION COSTS

Three 150-kva. General Electric transformers	$2,650.50
One set of Delta Star arresters and fuses	150.00
Copper for bus	30.59
Three disconnects	31.50
Two meters	80.00
Poles, cross-arms, insulators and hardware	50.01
Labor	170.00
Fence, paint and miscellaneous	40.40
Total cost of substation	$3,203.00
Cost of extension	2,049.00
Cost of extension plus substation	$5,251.00
Cost per kilovolt-ampere (extension plus substation)	11.70
Cost per kilovolt-ampere (substation only)	7.10

CONTRACT DATA

Duration of contract	Five years
Horsepower contracted for	480
Hours of service	Twenty-four
Service charge per horsepower per month	$0.75
Additional charge per kilowatt-hour used	5.0 mills
Guranteed minimum payment	$1,800.00 per year
Actual kilowatt-hours consumed per year	1,091,094
Gross revenue per year	$6,659.00

The metering is done on the secondary side of the transformers. The power is used by the following General Electric motors: Two 50, one 75 form K squirrel-cage induction motors; one 75, one 100 form M slip-ring motors; one 200-hp. form L internal resistance induction motor.

TABLE VIII—COST OF SUBSTATION CONSTRUCTION TO SERVE A KAOLIN MINE

The installation in Fig. 9 is rated at 150 kva. The primary voltage is 13,000, three-phase, 60 cycles; secondary, 550 volts, three-phase. The substation is located 7900 ft. from the main distribution line.

SUBSTATION COSTS

Three 50-kva. General Electric transformers	$963.00
Burke horn-type switches, fuses, disconnects	300.00
Meter and equipment (Westinghouse)	220.00
Poles, insulators, cross-arms and hardware	51.69
Copper, guys, etc	21.91
Labor	38.00
Fence, transportation, miscellaneous	49.00
Meter house	37.40
Total station costs	1,681.00
Cost of extension	1,372.00
Total cost extension and station	$3,053.00
Cost per kilovolt-ampere (extension and station)	20.35
Cost per kilovolt-ampere (station only)	11.20

CONTRACT DATA

Duration of contract	Two years
Horsepower contracted for	100
Hours of service	Twenty-four for twelve months
Service charge per horsepower per month	$0.75
Additional charge per kilowatt-hour	11.0 mills
Guaranteed minimum payment	$100.00 per month

Metering is done on the primary side of the transformers. The customer furnished right-of-way for power lines. Power used by Wagner slip-ring motors for hoists, shovels to remove the overburden, grinding and conveying the product, in the mining of kaolin (chalk), which is sold for paper making.

At the expiration of the contract the customer has the privilege of renewing from year to year at the above specified rates.

Poles for power line are spaced from 200 to 300 ft. apart.

TABLE IX—COST OF SUBSTATION CONSTRUCTION TO SERVE A SILK MILL

This installation is rated at 225 kva. The primary voltage is 13,000, three-phase, 60 cycles; secondary, 550 volts, three-phase. The substation is located 250 ft. from the main distribution line.

COST OF INSTALLATION

Poles, cross-arms, insulators and hardware	$105.60
Westinghouse graphic and watt-hour meters, current and potential transformers	450.00
Meter box, transformer, framework, etc	65.00
One set Delta star switches, fuses and arresters	150.00
Disconnects	65.00
Wire and conduit	76.60
Labor, paint and miscellaneous	150.50
Total cost	$1,062.70
Cost per kilovolt-ampere	$4.70

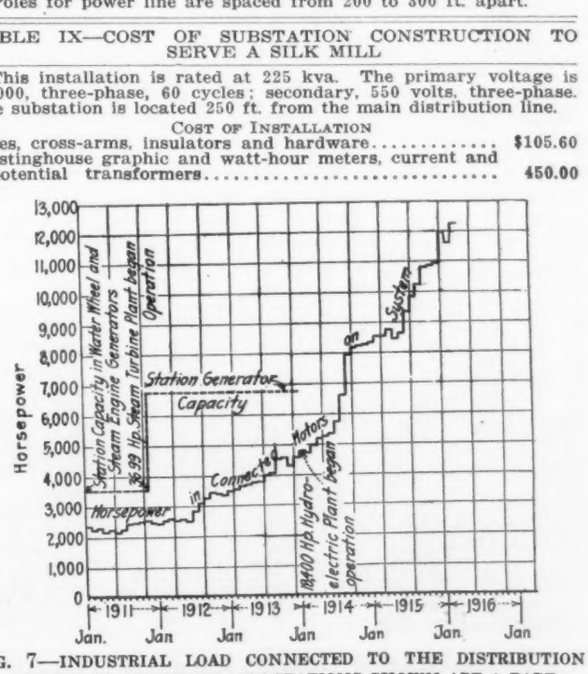


FIG. 7—INDUSTRIAL LOAD CONNECTED TO THE DISTRIBUTION SYSTEM OF WHICH THE SUBSTATIONS SHOWN ARE A PART

CONTRACT DATA

Duration of contract	Five years
Horsepower contracted for	214 in the day and 27 at night
Service charge per horsepower per year,	$25.00 of maximum demand
Guaranteed minimum payment	$1,200.00 per year
Gross revenue for twelve months, 1915	$2,452.00

The customer furnished transformers and contracted for primary power. In event secondary power is used the rate is to be reduced to $1.25 per month per horsepower and minimum charge to be $2,400.00. If primary power for a maximum demand of 200 horsepower is used the rates will be $20 per year per horsepower of maximum demand and the minimum charge shall be $4,000 per year. General Electric form K squirrel cage motors are used.

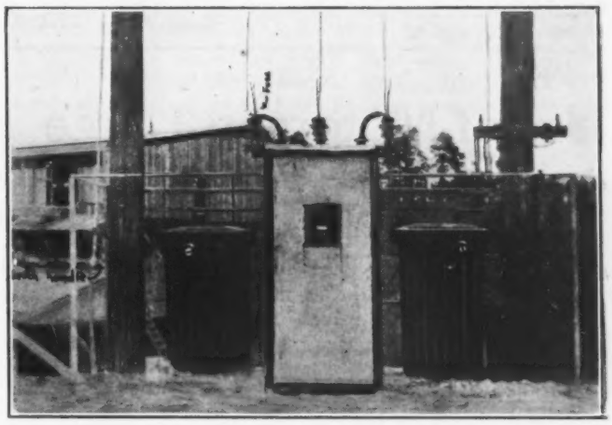


FIG. 8—A 150-KVA. SUBSTATION THAT SERVES A KAOLIN MINE

TABLE X—COST OF EXTENSION CONSTRUCTION TO SERVE A COTTON MILL

This installation is rated at 750 kva. The primary voltage is 13,000, three phase, 60 cycles; secondary 550 volts, three phase. The substation was furnished by the consumer and is located 500 ft. from the main distribution line.

COST OF EXTENSION

40-ft. poles	$16.00
Cross-arms, insulators and hardware	45.20
Disconnects	72.00
No. 2 H. D. copper	50.00
Labor	52.00
One Westinghouse graphic meter	111.05
One Westinghouse watt-hour meter	37.94
Two potential transformers	229.31
Two current transformers	71.64
Total cost	$685.14

CONTRACT DATA

Duration of contract	Five years
Horsepower contracted for	737 in the day and 134 at night
Hours of service	Twenty-four
Service charge per horsepower per month	$1 per horsepower of maximum demand or optional $0.015 per kilowatt-hour
Actual kilowatt-hours consumed in 1915	1,896,660
Gross revenue on demand basis	$9,985.00
Guaranteed minimum payment	$5,100 per year

Secondary power is contracted for, and if at any time a change is made calling for primary power the cost will be $1.50 per horsepower per month. The equipment of this mill consists of the following motors, which drive some 27,000 spindles: three 75-hp., twelve 50-hp., and one 5-hp. form L, General Electric mill motors.

TESTS TO INSURE CONTINUITY OF SERVICE

Provision is made to test insulators with an oscillation transformer before they are put in service. Periodic tests are made by the patrolmen with a 2000-ohm telephone receiver in series, connected by two spikes which are stuck in the pole and ground respectively. By this means leaking insulators are sometimes found that will save interruptions to service. The lines are patroled regularly to detect broken pins, insulators or tie wires. At the substation proper a sample of oil is removed periodically from oil switches and transformers for test, and if required this oil is dried and filtered by means of a portable General Electric motor-driven drying outfit without interrupting service.

The arresters, electrolytic and other types, are watched to detect punctured cones, bad resistances and other defects. Relays in the stations and on customers' installations are tested and set to trip properly. Voltage and load tests are also made on the motors. The meters are, of course, periodically tested. Where the customer pays for energy by the kilowatt-hour or watt-hour meter only, the tests are made more frequently than for those that pay by a maximum demand or recording wattmeter, in addition to a watt-hour meter.

Considerable attention is given to the size of the fuse on the circuits and the relays are set, giving them sufficient time to allow certain fuses to clear ahead of the switches so as to eliminate a shut-down to all of the customers on a feeder.

The industrial horsepower load connected to this distribution system is shown in Fig. 7. The large increases speak admirably for the service given, and this increase is made possible largely by installation of the out-door substations shown. In general the only disadvantages found by the advocates of the in-door types are: the greater risks to the public, the difficulty in making repairs and the less reliability to service. In the installations shown the first objection is remedied by the wire fence, and the latter is not so objectionable in the South where there are few snow or sleet storms.

Use of Motors in Large Tunnel Construction Work

How the City of Chicago Is Making Use of Purchased Energy for Lighting and Power in the Construction of Its New Water Supply Tunnel

TO meet the increased demand for water the city of Chicago is building a tunnel from about 4 miles out under Lake Michigan to some 5 miles inland. The water will be taken in from the lake at one end and pumped out at the other end. The depth of this tunnel will vary from about 200 ft. at the lake shore to some 35 ft. at the far end, where the pumping station is to be built. This tunnel will be elliptical in shape, with an axis of about 15 ft., and will be lined throughout with concrete. To assist in the work of boring and removing the débris four shafts have been bored, one at the lake front, one at the inland end and the other two judiciously spaced. The work is being carried out by the city of Chicago, under the direct supervision of John Ericson, city engineer.

This project is of more than passing interest to electrical engineers, apart from the general engineering features involved because electricity is used almost entirely for power applications, the energy being purchased from the local central station company. Power is supplied by the Commonwealth Edison Company from its distributing network, at 4000/2300 volts, as for other customers. These circuits carry both power and lighting in the main, although sometimes a power load will be the only load served. Each shaft has called for an out-door substation composed of distributing transformers on poles. Shaft No. 1 is supplied from one circuit, and is the only load on that circuit; Shaft No. 2 is supplied from the same station as No. 1 but from a different circuit, which also carries lighting load, in the neighboring residential district. Shafts Nos. 3 and 4 are both supplied from the same circuit. A considerable portion of the circuits supplying power are installed underground.

The transformers are unprotected on the primary side, being cut in to the supply lines direct through G. & W. potheads of the disconnective type. The transformer secondaries are protected at the switchboard, however, and also each motor, by fuses. These transformers are connected in star on the primary with the neutrals of the transformers tied together but isolated from the neutral or fourth conductor. The secondaries are connected in delta, thus constituting a closed circuit for the circulation of the third-harmonic component of the exciting current, which would otherwise distort the wave form and thereby affect the core losses of the transformers. Isolating the transformer neutrals also tends toward increased reliability. The motors are also protected by no-voltage tripping devices. Each installation is metered separately, the metering being on the low-voltage or 220-volt side of the transformers since power is purchased on the low-voltage or transformed basis. At each shaft an inte-

TABLE I—MOTORS USED IN TUNNEL CONSTRUCTION WORK

Shaft Number	Transformer Rating in Kilowatts	Number and Horsepower Rating of Motors	Application	Service
1	6— 75	4—100	Compressors	Continuous
		1— 75	Hoist	Intermittent
2	3—100	3—100	Compressors	Continuous
		1— 50	Hoist	Intermittent
		1—100	Air compressor	Reserve
3	3—100	3—100	Compressors	Continuous
		1— 50	Hoist	Intermittent
		2— 25	Fans	Continuous
		1—100	Air compressor	Reserve
4	3—100	1—100	Compressor	Continuous
		1— 50	Hoist	Intermittent
		2— 25	Fans	Continuous

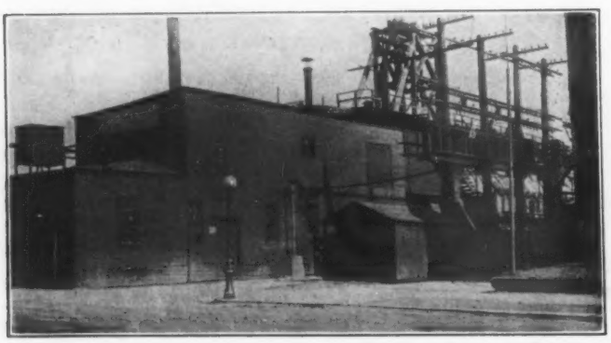


FIG. 1—TRANSFORMER BANKS AT SHAFT NO. 1

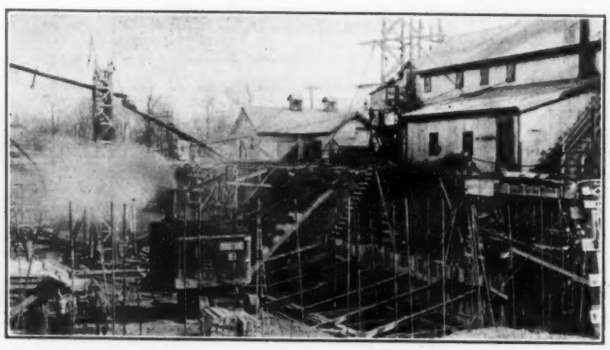


FIG. 2—EXCAVATION AT SHAFT NO. 4 FOR PUMPING STATION

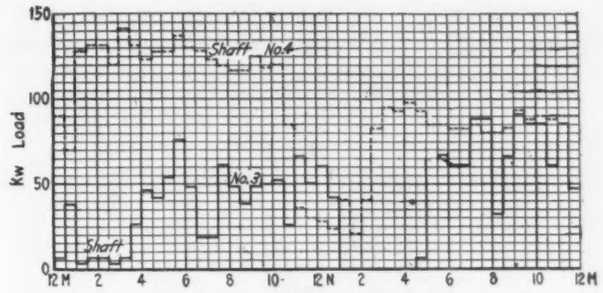


FIG. 3—AVERAGE LOADS AT SHAFTS NOS. 3 AND 4

Maximum load at shaft No. 3, 93 kw.; maximum load at shaft No. 4, 144 kw.

grating watt-hour meter is used with a printometer that registers the demand every half hour. These meters are the property of the public service company. In addition Bristol graphic wattmeters are sometimes installed by the city for its own benefit.

Since the tunnel construction work has been in progress no delays have occurred that are chargeable to central station service. Delays have, indeed, been comparatively few, and in the main due to blown fuses and burnt-out motors. The distributing network of the central station company has been laid out to safeguard its customers against trouble in its network or outside. Emergency ties permit the load being transferred from a circuit in trouble, to one and sometimes two others without affecting seriously the voltage regulation of either circuit. These tie switches are as a rule placed at the junction where the underground cable becomes aerial, since this permits easy switching of the overhead to some other source of supply should trouble develop underground. Except where the trouble develops suddenly the load may be transferred from circuit to circuit without interrupting the continuity of power supply. These emergency ties are an integral part of the Commonwealth Edison Company's system and for this purpose G. & W. potheads of the disconnective type are used.

The work in the tunnel goes on day and night, seven days in the week, mules and men working eight-hour shifts. The loads on the different transformer banks vary, of course, from time to time and from month to month as the work progresses, and are decreasing somewhat as the tunnel approaches completion since material—cement mainly—is taken down into the tunnel instead of large quantities of rock and other débris being brought up. In Figs. 3 and 4 typical curves of kilowatt-hour loads at the four tunnels are shown at the time the boring was going on and rock being brought out.

It has been necessary to bore the tunnel through rock almost its entire length, which has required some heavy and extensive blasting. Here electricity is used wherever feasible. The hoists are electrically operated, while the drilling and concrete mixers are operated by compressed air, which are in turn motor driven. Material is transported through the tunnel in dump cars drawn by mules. At Shaft No. 4 a large derrick and cement mixer are both steam driven because here it would be rather inconvenient to use electric conductors because of the area covered. In the tunnel air is piped to the concrete mixers and cement is also forced by compressed air to the forms. The forms are of the collapsible type, six forms of 5 ft. each constituting a unit. The use of electricity indirectly instead of directly is more convenient in the present case, because the tunnel is very wet, the track being under water in many places. The electric lighting in the tunnel is in the most part by individual and clusters of incandescent lamps, although searchlights are being used at Shaft No. 4 where excavating for the pumping station is going on twenty-four hours per day. Apart from the strings of electric lights along the tunnel each man is equipped with a miner's acetylene lamp which he can hook to his hat, rated for four hours. These lamps are convenient and advisable as a safeguard should the lights in the tunnel go out due to a blown fuse or similar cause.

This construction work is an interesting example of co-operation between contractor—in this case the city—and the central station company to the mutual advantage of each and likewise to the public. The use of central station service in this instance has brought about economy in the initial cost of doing the work, in power, labor and insurance, with a higher degree of reliability obtained than could otherwise be secured. For the central station company such a load means increased income, higher load factors at practically no, or at most only a very small, additional outlay. By purchasing central station service the contractor saves himself the trouble and annoyance of steam or oil engines.

The motor needs and receives less attention than other types of machines, constitutes less danger, and needs no licensed operator to manage it, thus enabling lower insurance rates and labor costs. Banked fires are absent in the case of the motor, and no fuel need be brought to it over roads already in bad condition due to congested traffic and seasonal conditions. The motor is noiseless—an important consideration where the work is being done in the heart of residential districts as is the case here, the more so since work is being pushed day and night. The first cost of a motor is lower than is that of the steam engine, and motors may be rented from the central station company usually for a nominal fee, whereas engines have usually to be bought, and sold at a loss when there is no further work for them to do.

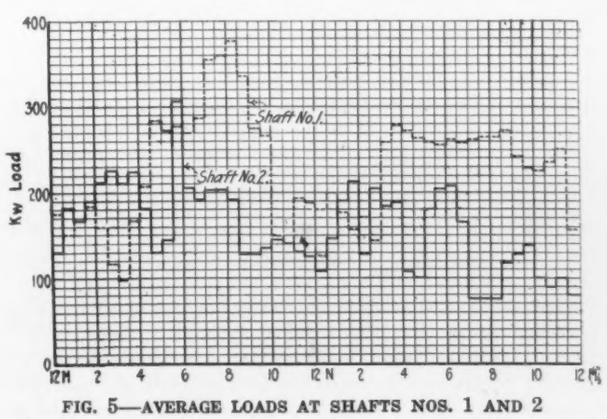


FIG. 5—AVERAGE LOADS AT SHAFTS NOS. 1 AND 2

Maximum load at shaft No. 1, 377 kw., load factor 54 per cent; maximum load shaft No. 2, 307 kw., load factor 44 per cent.

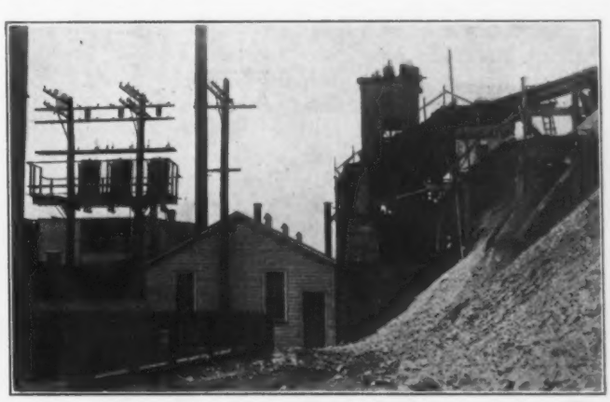
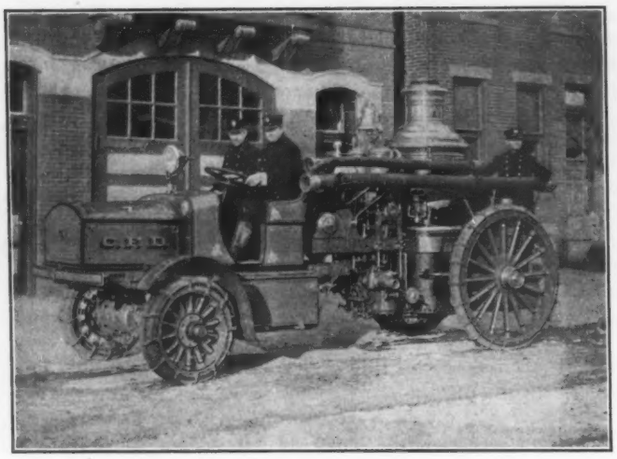
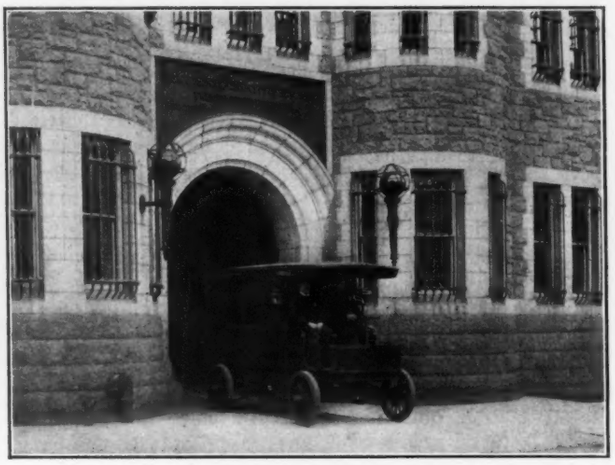


FIG. 4—TRANSFORMER BANK AT SHAFT NO. 2 IN RESIDENTIAL DISTRICT



AN ELECTRIC "STEAMER" CONVERTED FROM HORSE OPERATION



ONE OF NEW YORK CITY'S ELECTRIC "HURRY UP" WAGONS

Electric Trucks in Government and City Service

Superior Usefulness of Battery-Driven Car Thoroughly Demonstrated in Fields of Federal and Municipal Transportation—The Central Station Man's Opportunity

THE splendid achievements of the electric truck in government and city service, and methods by which such applications of the electric vehicle can be broadened and used as the leverage for opening up those broader commercial and industrial fields for which the battery-driven car is so eminently fitted, were described by the committee on federal and municipal transportation of the Electric Vehicle Section, N. E. L. A., in its report presented before the Chicago convention on May 25. Past work of the former Electric Vehicle Association was commended, and confidence was expressed that the recent affiliation with the N. E. L. A. will put the whole central station industry squarely behind the electric vehicle.

"No well-studied plan looking to the broadest introduction and development of the 'electric' can omit consideration of the part to be played by the central station in expediting vehicle sales as well as in sponsoring the subsequent operation of the 'electric' in service," declared the committee.

Educating the Public Through the Central Station

"Until the central station man has learned the whole electric vehicle story—and has learned it so well that he can retell it to his customers and home-town friends with such ring of conviction that prospective users will heed and themselves believe—until this local 'electrical authority' of each community is enlisted in the campaign, attempts to win and to hold the business of the ultimate user can have only sporadic success, and will in the main be ammunition and effort wasted.

"And an early step in the self-education of the central station on electric vehicle subjects should be the purchase of a company car or truck, to prove to its business neighbors that the central station is itself willing to take what it prescribes for others.

"Already some 12,000 electric commercial wagons and trucks are in operation in this country, and each day their number grows and the range of their application widens. But the fullest development of this field will be achieved only through full co-operation, and through united effort on the part of all interested to make the electric the success that its intrinsic merit justifies.

"But it is in the field of government and municipal uses of electric vehicles that the central station will not only find great and diversified opportunities for the introduction of electrics and the sale of energy, but will also discover itself particularly well situated to encourage the adoption of such vehicles.

"Proven applications of the electric vehicle now cover every branch of municipal service. There is no requirement of high speed, great carrying power, or flexibility of operation and closeness of speed control which is not fulfilled by the electric better than by any other means of transportation.

"Taken with the advantages already mentioned—the well-known dependability and simplicity of the electric, its economy of upkeep, its long, useful life, and its adaptability for operation by others than its particular driver—all make it the type of vehicle best suited for municipal service.

"For convenience of reference, the following list is presented of some of the applications to which electric vehicles have been put in municipal and government service:

"Municipal—*Emergency:* Fire apparatus; police patrols; ambulances. *Street Department:* Sweeping and cleaning; sprinkling carts. *Disposal:* Ash carts; garbage wagons. *Miscellaneous:* Departments of public works; city engineer's office; water department; school buses; road rollers.

"Federal—*Post-office:* Mail transfer; parcel-post delivery. *Navy Yards. Mints. Washington Bureaus.*

"Already the municipality is, in the case of the average city or town, itself the largest single customer of the local central station. For lighting the streets, pumping water, serving public buildings, etc., the company holds annual contracts. Having thus become virtually one of the essential departments of municipal operation, the central station can be counted upon to be in close touch with the city government in all its branches. Through these connections it has learned to know intimately the officials and the 'powers behind the scenes.'

"Moreover, the central station manager is invariably an active figure in all the local commercial bodies, boards of trade or chambers of commerce. In these meetings, through co-operation with his fellow business men, the manager can also bring to bear potent influences of public opinion.

"In the minds of many of the public, the stamp of approval of any government department—be it federal, state or municipal—is taken as an authoritative award of merit. Here is a point concerning the use of electrics in any government service, the publicity value of which must not be overlooked.

MOTOR VEHICLES SOON IN ALL CITY DEPARTMENTS

"The early motorization of practically all municipal equipment formerly drawn by horses is now a foregone conclusion. Whether this motorization of fire apparatus, police wagons, ambulances, street cleaning apparatus, etc., shall be by electric vehicles or by gasoline cars is a question which is going to be determined for each community within a few months, or years at the outside—and settled upon, too, in plain sight of the local central station man. Meanwhile, the rising price of gasoline is a factor that is, of course, increasingly favorable to electric transportation. If the central station man will but grasp the opportunity now before him, and secure the adoption of electric vehicles, he will achieve for his community the most modern of municipal transportation equipment, and to his own interests a powerful testimonial for electric trucks and electric service.

ELECTRICS IN FIRE DEPARTMENT SERVICE

"One of the most interesting municipal applications of the electric truck is in the transportation of fire-engines and other fire department apparatus formerly drawn by horses. Equipment of this kind is now in successful use in New York; Philadelphia; Camden, N. J.; Springfield, Mass.; Akron, Ohio, and Hartford, Conn., and in Berlin, Hamburg and other European cities.

"In two of the Philadelphia fire houses there have been quartered at the same time gasoline, electric and horse-drawn pieces. On average runs of from six blocks to 1.5 miles, the electrics have invariably been first to the fire. In a large city it is almost impossible to clear the street of all traffic; hence the apparatus is forced to slow down for teams and trolleys. For the gasoline car, this means shifting of gears and a snorting engine caused by over-supply of gasoline, due to the driver feeding the engine too rapidly in his haste to make time. Meanwhile the electric, having no gears to shift, rapidly accelerates and by thus continuously gaining over the others, is first to reach the fire.

POLICE PATROLS AND AMBULANCES

"Many of the points of advantage of the electric truck in fire department service apply also in a discussion of electric ambulances and of electric 'hurry-up' wagons for police departments. The electric patrol wagon can be operated by any officer besides its regular driver. It is clean and sanitary, and it introduces no odors of burned hydrocarbons into the station house where the patrolmen await calls. The electric's virtue of cleanliness is of particular advantage, of course, in ambulance work. Its silence and its easy-riding qualities are points of grateful comfort to the sick.

STREET CLEANING AND REFUSE REMOVAL

"In the fields of street cleaning and garbage haulage an interesting development of comparatively recent date has been the battery-operated tractor—a four-wheeled vehicle which can be coupled up to any desired trailer body or piece of street-cleaning apparatus — which trailer is usually carried on a two-wheel truck.

"One type of electric truck designed for municipal service has interchangeable ash-cart and sprinkling-tank bodies, so that after the close of the summer and fall sprinkling seasons, the running gear may be utilized during the remaining months of the year for carting ashes, etc. The mileage covered by street cleaning and sweeping equipment is seldom very great, since the machines are operated to best advantage at very low speeds. Some of the large cities of Europe have their streets swept and sprinkled entirely by electric vehicles.

"Park departments require trucks and wagons for moving dirt and fertilizer, for setting out plants, for carrying equipment used to destroy insect pests and treat injured trees, etc. If electric, these vehicles will not soil park walks or drives, nor pollute the atmosphere with odors of incompletely burned petroleum products—points to be considered in selecting vehicles to operate from place to place ten hours a day in a city's pleasure grounds. School buses offer another "electric" opportunity.

TRANSPORTING THE MAILS BY ELECTRIC TRUCKS

"The growing appreciation and recognition of the electric by the Post-office Department at Washington is indicated by the recent official call for bids on equipment for the Chicago post-office, for which service electric trucks were specified.

"In New York City twenty-four 2-ton trucks are used for transferring mail matter between the railroad stations and the various post-offices. In addition a number of 1000-lb. and 1-ton wagons are now employed for delivering parcel-post packages from the various postal distributing centers."

The members of the committee were: James H. McGraw, chairman; O. H. Caldwell, F. N. Carle, G. A. Freeman, W. C. Johnson, W. P. Kennedy, C. M. Marsh, F. B. Neeley and F. W. Smith.

ELECTRIC REFUSE CART, WITH DUMPING BODY

THE ELECTRIC EXCELS IN PARCEL-POST DELIVERY

Correcting Turbine Test Results

Necessary Corrections for Variations of Pressure, Superheat and Vacuum to Compare Water Rates of Steam Units

By H. A. Cozzens, Jr.

The conditions of pressure, superheat and vacuum determine to a large extent the design of a turbine. The builder is supplied with these data before he undertakes to construct the machine and quotes the performance in pounds of steam per kilowatt-hour on the assumption that the turbine will operate under the prescribed conditions. It is often of interest to compare the performances of steam turbines when operating under conditions which vary to some degree. If two turbines built to operate under similar conditions are to be compared when the conditions vary, the performance of one turbine must be equated to that of the other or to the individual guarantee of each. The conditions during the test may vary, due to several causes. For instance, one test may be run in January when it is easy to maintain a high vacuum since the water is cold, while the other may be run in the summer and the vacuum fall an inch or more. The vacuum condition has the greatest effect on the steam consumption of the turbine so that the test made in the summer would show a higher steam consumption than the test run in the winter. Instead of assuming two turbines it might be desired to compare the tests of the same turbine run at different times.

Again, before a turbine is turned over to an operating company an acceptance test is usually made. This test is run under operating conditions and the results equated to the conditions of the guarantee. With large units the tests must usually be conducted in the power station after the unit has been installed and under conditions that vary to a considerable extent. With large-sized units it is practically impossible to make shop tests as in the case of small units for several reasons. Among these might be mentioned the necessity for a huge boiler equipment to supply steam for the units, and the practical impossibility of maintaining ranges of pressure and superheat for several units. Again, the question of securing the proper load conditions is one that presents difficulties.

The standardization of turbine tests is usually accomplished by increasing or decreasing the test water rate obtained by a predetermined percentage for a variation in pressure, superheat and vacuum from the conditions as stated in the guarantee. This brings the turbine test performance to the same basis as the guarantee and permits proper comparison of the performances.

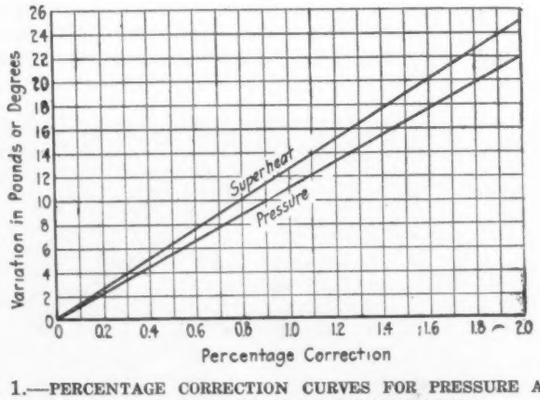


FIG. 1.—PERCENTAGE CORRECTION CURVES FOR PRESSURE AND SUPERHEAT VARIATIONS OF TURBINE TESTS

The conditions of pressure and superheat do not vary greatly enough in the average power house to affect the turbine performance to a very large degree. Numerous tests have determined that the corrections for these two conditions should be 1 per cent for every 11 lb. variation in pressure and 1 per cent for every 12.5 deg. Fahr. of superheat variation. The correction to be applied for vacuum variation varies from 3 to 6 per cent at the higher vacuum. Usually about 5 per cent is taken as the correction factor for each inch variation. In tests where little is known concerning the effect of vacuum on the unit, it is not always satisfactory to assume a certain percentage so that it becomes necessary to run tests to ascertain the precise effect and correction. The usual procedure in such a test is to hold the load steady at three or four points and operate at vacuums of 28 in., 28.5 in. and 29 in. (corrected to a 30-in. barometer) by admitting air into the condenser. From these data the proper correction factor may be obtained. The corrections are added or subtracted from the steam consumption as obtained during the test according to whether the operating conditions are above or below those of the guarantee. If the test conditions are above the corrections should be added.

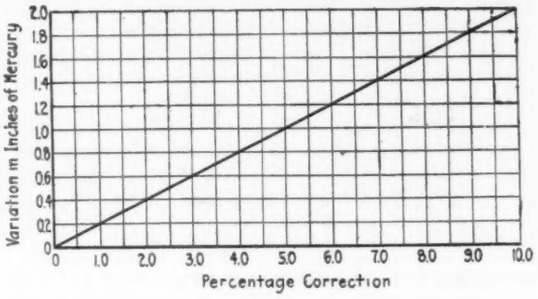


FIG. 2—PERCENTAGE CORRECTION CURVE FOR VACUUM VARIATIONS OF TESTS

TABLE I—CORRECTIONS TO WATER RATE SHOWN BY TEST DATA

Standard Conditions:				
Steam pressure at throttle	190 lb.			
Superheat	100° F.			
Vacuum at turbine exhaust	28.5" Hg.			
Test Results:				
Pressure	198	194	192	201
Superheat	115	89	93	106
Vacuum	29.4	29.4	29.3	29.2
Test Water Rate:				
Pounds per kilowatt-hour	13.65	13.17	13.52	13.27
Percentage Corrections:				
Pressure	+0.73	+0.36	+0.18	+1.00
Superheat	+1.20	—0.88	—0.56	+0.48
Vacuum	+4.50	+4.50	+4.00	+3.50
Total	+6.43	+3.98	+3.62	+4.98
Correction in pounds	+0.88	+0.52	+0.48	+0.66
Corrected Water Rate:				
Pounds per kilowatt-hour	14.52	13.69	14.00	13.93

As a simple example let us consider that the vacuum correction is 1 lb. of water for each inch variation. With this as a basis, assume that the guaranteed vacuum is 28 in. and the vacuum on the test was 29 in., at which point the turbine had a water rate of 14 lb. per kilowatt-hour. Since the test vacuum is greater than the guarantee by 1 in. we would add 1 lb. to the water rate, making the consumption 15 lb. per kilowatt-hour with a 28-in. vacuum instead of 14 lb. per kilowatt-hour as shown by the test.

In order to eliminate the mathematical work in computing corrections to be applied to test results the accompanying curves have been drawn which will serve as models for drawing curves for various correction factors to suit individual conditions. The accompanying table is a summary of a turbine test in which the water rate has been corrected by the use of such curves and shows a convenient form for recording test data when comparisons of the performances of steam turbines are being made.

STATION AND OPERATING PRACTICE

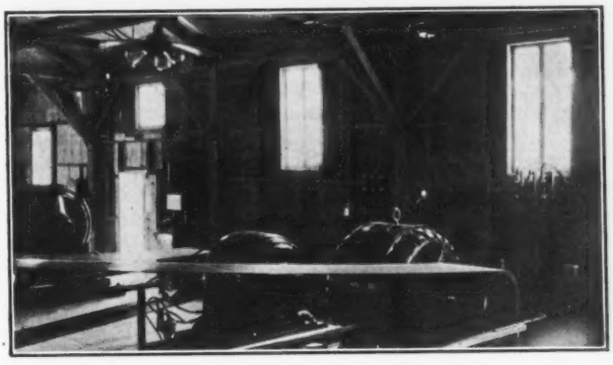
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Regulating Industrial Plant Loads to Maintain High Load Factors

How a Western Cement Mill, Through a Load Dispatcher, Handles 16,000-Hp. Motor Load to Obtain a 90-Per Cent Load Factor and Secures Low Energy Rate

BY W. L. FROST
District Agent Southern California Edison Company

The Southern California Edison Company has a connected motor load of 26,560 hp. in the Redlands district, where it has developed load factor conditions more advantageous than in any other of the thirteen districts into which the company's system is divided. The average monthly load factor in the district for 1915 was 75.16 per cent. The highest was 81 per cent and the



TWO 250-HP. AND ONE 350-HP. MOTORS DRIVING AIR COMPRESSORS IN PLANT OF CALIFORNIA CEMENT COMPANY

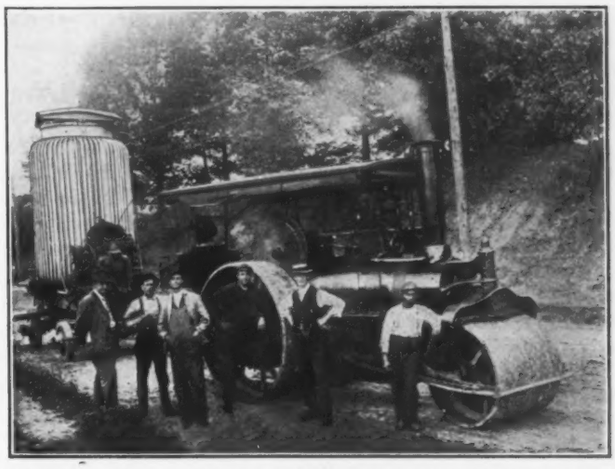
lowest 71 per cent. These conditions are due in the main to the fact that the company serves the Riverside Portland Cement Company, the California Portland Cement Company, two large citrus pre-cooling plants operated by the Santa Fé and Southern Pacific Railroads, the Santa Fé shops at San Bernardino, and about 300 pumping plants. As Redlands is the center of the orange-growing industry, these pumping plants run at a high load factor, furnishing water for irrigating the groves during the months of May to October, inclusive.

The Riverside Portland Cement Company operates 173 motors, having a connected load of 8835 hp., while the California Portland Cement Company operates 164 motors totaling 7163 hp. These plants run twenty-four hours daily. Their minimum capacity is 3000 barrels of cement per day and the maximum 6000 barrels. The annual consumption of the two plants is between 30,000,000 and 40,000,000 kw.-hr. In order to induce the mills to use this large block of power in a manner agreeable to the power company, it was decided to make the rate dependent upon the load factor. A contract was accordingly made under which the cement companies agree to maintain a monthly load factor of 90 per cent. With 90 per cent as a starting point, the price for current varies inversely with the load factor so that it is to the advantage of the cement company to keep the load constant and as near maximum as feasible. In fact, each of the cement plants has found it economical to keep a load dispatcher constantly in attendance at the switchboards to regulate the power demand. During the year 1915 both of the plants had average monthly load factors of more than 90 per cent.

Several motors with a total capacity of 1200 hp. are located in the "raw" or grinding end of the plants, and about the same number and capacity are in the finishing end. The load dispatchers watch the curve-drawing wattmeter very closely. In case the curve varies from the predetermined load which it is desired to maintain, the load dispatcher signals to the raw or finishing plants by means of compressed air whistles, to increase or lower the load, as desired. At the present time the combined rating of the raw and finishing motors in each plant is about 2000 kw. As they can drop off any desired part of this load without interfering with the operation of the other machinery, the maintenance of a very high load factor is primarily a matter of control.

Hauling a 12-Ton Transformer Filled with Oil Over a Country Road

The accompanying illustration shows a transportation scheme recently used by the Georgia Railway & Power Company, Atlanta, Ga., when it was necessary to move three 1000-kva. tubular type oil-cooled 11,000/22,000 transformers filled with oil from one of the company's substations to another. The substations were a considerable distance apart and not connected directly with a street car line. It was, however, possible to use a street car line a greater part of the distance and haul the units one at a time on a freight flat car drawn by one of the company's double-truck work cars. The final location of the units was about three-quarters of a mile from the car line, and for transporting the transformers over this distance the scheme shown was employed. To use the low truck on which the transformer was loaded it was necessary to lay a track of two 12-in. planks for the wheels to run on over certain bad sections of the road. Under these conditions and by use of the steam road roller, the transformers, which weighed 12 tons each, were moved without removing the oil.

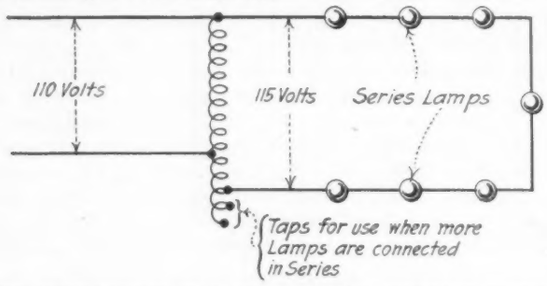


STEAM ROLLER HAULING A 1000-KVA. TRANSFORMER FILLED WITH OIL

Operating Series Gas-Filled Lamps from 110-volt Circuit

By Oscar Sorenson

In one town served by the Citizens Light, Heat & Power Company of Canby, Minn., it became necessary to substitute Type-C lamps for seven Type-B series units rated at 4-amp., 23 volts, 80 cp., and connected in series with compensators across a 220-volt commercial circuit. Owing to the difference in the requirements of the two types, however, it was impracticable to merely insert the new lamps in the old-lamp sockets. Furthermore, a voltage of 110 available from the lighting circuit would have been too small for seven Type-C lamps in series. It was therefore decided to "boost" the 110-volt pressure so the desired number of lamps could be operated in series.



HOW COMPENSATOR WAS CONNECTED TO CONSTANT-POTENTIAL SYSTEM TO SERVE SERIES LAMPS

To avoid buying special equipment a damaged motor-starting compensator was utilized by removing the faulty coil and locating 115-volt, 120-volt and 125-volt taps on the undamaged winding with a voltmeter. Thus modified, the compensator was placed in an old transformer case, wedged in place, covered with transformer oil and the primary terminals connected with the 110-volt service circuit through a switch. The series lamp circuit was connected with the 115-volt taps. About one-third less turns should have been provided on the compensator for it to perform its duty correctly when lamps "go out," but this is not considered absolutely necessary in the case since the residents of this town report lamp outages promptly. The lamp circuit is controlled from a primary switch to eliminate core loss when the lamps are not lighted.

Operating Results for Small Indiana Combined Water, Ice and Electric Plant

By C. E. Layton

At Sheridan, Ind., a town of 1800 population, a combined electric service, water and ice plant shows an electric income of $7.22 per inhabitant or $25.32 per consumer a year, although a liberal supply of natural gas is available at 25 cents per 1000 cu. ft. It may be pointed out, however, that the town is probably more advanced commercially than the average town of its size. There are 450 customers, including 333 residence, 101 business and sixteen power users, which represents about 25 per cent saturation. According to a recent census there are about 153 more possible consumers, which, if secured, will increase the saturation to one consumer for every 3 1/3 inhabitants. The total income may be classified as follows:

Electric—		
Commercial lighting	$7,418.17	
Street lighting	1,947.82	
Power	2,031.05	
Total electric	$11,397.04	$11,397.04
Water and ice		8,888.84
Total income		$20,285.88

Of this 61.9 per cent is required for operating expenses, not including interest or depreciation. Energy is delivered to the switchboard at a cost of 1.993 cents per kilowatt-hour. Including interest and depreciation the total cost of delivering electricity to consumers is 4.195 cents per kilowatt-hour. The investment for a plant of this size is usually assumed to be relatively high in comparison with the population, but experience with this system has seemed to indicate that profitable results can be obtained in small towns. On the other hand, small plants do not have to carry such relatively high charges as large systems or combinations.

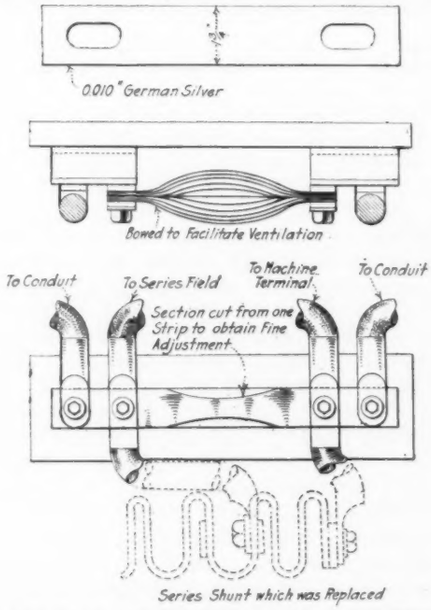
The electric plant at Sheridan was originally constructed and operated by the town. A meager income over a period of thirteen years, however, influenced it to sell to the present owners in January, 1913. Since then the income from sale of energy has been about doubled and the total income tripled. The water system, which was installed two and a half years ago, is relatively undeveloped, there being only 180 customers where at least 500 should be obtained in five to ten years. Water is pumped by electricity. Two years ago an 11-ton exhaust steam ice plant was installed which serves its purpose admirably.

The necessary exhaust steam is supplied by pumps and auxiliaries. Ice is sold wholesale at the plant, this arrangement proving satisfactory. The power plant includes horizontal tubular boilers and simple non-condensing engines. Duplicate equipment is installed to maintain a reliable service.

A Readily Adjustable Shunt for Series Fields of Exciters

By Sydney Fisher

In adjusting the compound characteristics of three exciters for parallel operation in conjunction with a Tirrill regulator, it was found impossible to get the



CONSTRUCTION OF SERIES-FIELD SHUNT SHOWING BOWED FORMATION TO FACILITATE VENTILATION

necessary series-field shunt adjustment with the shunt taps provided by the manufacturers. Consequently each shunt was replaced by a very simple and easily adjustable shunt like that shown in the accompanying drawing. By means of these the characteristics of the machines were made practically identical. The shunt is

made of strips of German silver slotted to permit the bowed formation shown. Rough adjustment is made by adding or removing strips, and finer adjustment is obtained by varying the cross-section of one of the strips. The free passage offered to air through the shunt permits good ventilation with resulting low temperature from no load to full load. The construction of the shunt permits using the minimum number of connections, therefore they can be made much more readily than where more connections are required. This is an important consideration since the resistance of poor contacts becomes appreciable, the series-field resistance being small.

Methods of Installing Fuse Switches for Transformer Installations

The accompanying illustrations show two methods of installing transformers to serve small industrial loads as used by the Roanoke (Va.) Railway & Electric Company. For installations up to and including 15 kva. it is the practice of this company to install the transformers on a pole as shown in Fig. 1. This installation is at the plant of the Virginia Can Company, Roanoke, and furnishes 220-volt, 60-cycle power service together with single-phase, three-wire lighting service. In installations of this kind it will be noted that the fuse switches used are mounted so that they may be operated by the lineman without any danger of coming in contact with live equipment if proper precautions in pole climbing are taken. The fuse switches used in this installation are known as W. N. Matthews & Brother's type A.

Whenever power service is required by a customer calling for more than 45 kva. in transformers, the pole platform construction shown in Fig. 2 is used. This installation is at the plant of the Roanoke Twine Mills, and consists of six 25-kw., type-H, General Electric

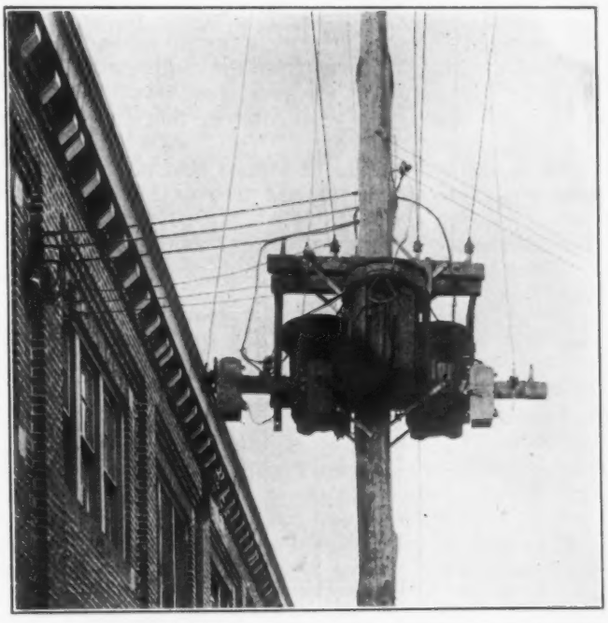


FIG. 1—INSTALLATION OF TRANSFORMERS AND FUSE SWITCHES AT PLANT OF VIRGINIA CAN COMPANY, ROANOKE, VA.

transformers furnishing three-phase, 220-volt service. The particular platform shown was designed for three 25-kw. transformers, but due to the rapid increase of load making it necessary to double the transformer rating, three 25-kw. transformers were added having the same characteristics until such a time that three 50-kw. units were available. It is considered best practice to use three transformers whenever possible and this practice is followed except in special cases, such as the one cited.

The method shown in Fig. 2 of supporting the 220-volt buses by means of Pierce secondary racks is standard practice followed by the company and makes a neat, safe and substantial construction. In addition to using

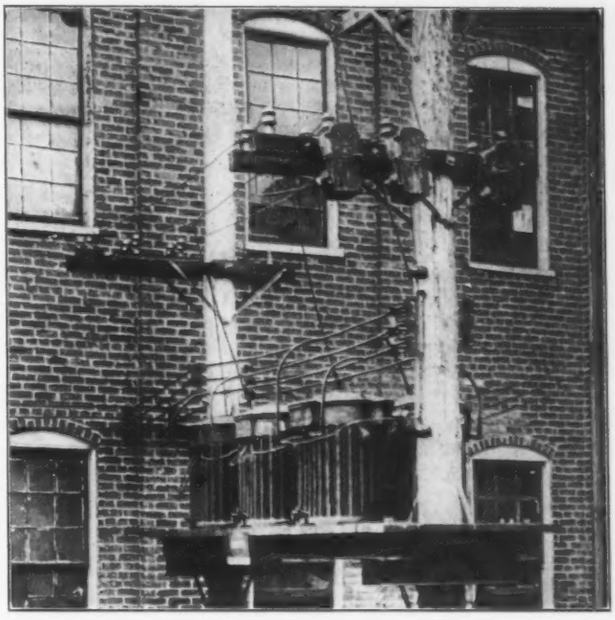


FIG. 2—POLE PLATFORM TRANSFORMER INSTALLATION, SHOWING MOUNTING OF SECONDARY BUSES AND FUSE SWITCHES AT PLANT OF ROANOKE (VA.) TWINE MILLS

the Matthews fuse switches on transformer installations as shown, this company also installs them at various places on its overhead system for tie lines and paints them red while those used as disconnecting switches are painted black. According to W. G. Claytor, superintendent of the lighting and power department of the Roanoke (Va.) Railway and Electric Company, this practice has been found convenient in cases of emergency or at times when the lines are being worked on.

"Hot" Versus "Dead" Methods of Banking Boilers

There appears to be no question as to the relative values of "hot" banking and "dead" banking of boilers according to the accompanying opinions expressed by the operator of a large Eastern plant. It is considered better practice to raise the boiler rating at the time of peak load in order to avoid banking losses. When it is desired to greatly increase the output of boilers forced draft must be used, it being considered that the loss due to forced draft is less than that due to keeping the boilers banked to carry peaks.

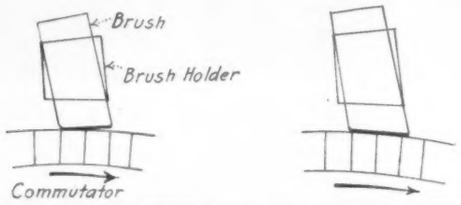
Hot banked boilers are of no use except possibly when the boiler is to be off the line for only a very short time, and the steam is not allowed to drop more than a few points. Dead banked boilers are so banked that they cause no steam to be generated. Before a boiler is taken from the line the feed to the coal magazine is shut off and the fuel remaining in the magazine is then burned out, thus preventing fresh coal from falling down over the fire while banked. When the coal has all been burned from the magazines, the fuel on the grates is worked until it covers about one-third of the grate area, care being taken to mass the

coal without air spaces. This coal is then covered with siftings saved for the purpose, and to such a depth that it just smoulders and barely keeps alive. The drawback of this method is that it allows the temperature of the boiler to drop very low, requiring a large expenditure of coal to bring it back up to line pressure. However, the method is a perfectly satisfactory means of keeping boilers while off the line. The remaining method of banking consists of nearly the same process as dead banking, but the layer of siftings put on the fuel bed is not as thick as in the former case, and the temperature of the fire stays up to a point at which it keeps up the radiation losses of the boiler to some extent. The coal required to bring the boiler up to line pressure is noticeably less than would be the case with the banked boiler.

Trimming Commutator Brushes Properly

BY LIONEL W. WYSS

Considerable trouble is often experienced with motor and dynamo brushes due to poor contact with the commutator. One method of trimming carbon brushes to bear on the commutator with full contact area is to place a strip of sandpaper on the commutator and draw it back and forth until the brush is shaped to have full contact area. This method is usually satisfactory unless the brush is loose in its holder, which is often the case.



FIGS. 1 AND 2—IMPROPERLY AND PROPERLY TRIMMED COMMUTATOR BRUSHES

If the usual method of drawing the sandpaper back and forth is used where the brush is loose in the holder it will not trim the brush to give full contact area on the commutator, because the brush will move in the holder and the edges will be trimmed more than the center, as shown in Fig. 1.

A better method is to sandpaper the brush only in the direction of commutator rotation, which will necessitate lifting the brush while the sandpaper is drawn in the direction opposite to commutator rotation. The friction of the commutator on the brush will hold the latter in the position shown in Fig. 2, and will allow full area in contact on the commutator, thereby preventing sparking and rattling.

A Substitute for Matting That Wears Well and Is Cheaper Than Rubber and Linoleums

BY R. I. ELKIN

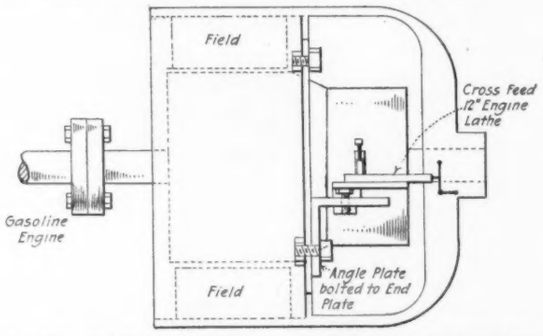
Rubber mats and linoleums are generally used for an insulating floor covering before switchboards to safeguard operators. These materials are rather objectionable, however, because they deteriorate rapidly, curl up at the edges unless prevented from doing so, become frayed, and give an uncertain degree of protection. Some large companies are now replacing such mats of rubber or linoleum with what is known as "mastic insulite." This is a compound of rubber, and probably asbestos. It is applied to cement floors very simply. First a waterproof priming is applied to the floor and then a coat of insulite. About six coats should be applied, each coat being allowed to dry before applying the next coating. Before applying a new coat a little powdered lime is sprinkled over the dried coating. The final coat—six coats are about 3/16 in. thick—should be polished with wax and gasoline.

"Mastic insulite" is of a dark brown color that harmonizes well with station apparatus. It wears well, does not crack nor show any abrasive action under foot. It has very high dielectric strength and does not absorb moisture. If stained with oil or grease all that is necessary is to wash with gasoline, when the stains are removed, which is not the case with cement flooring. This floor material costs about $2.25 per gallon, 1 gal. of which covers a floor of 60 sq. ft. The writer knows of cases where this covering has been in service for a number of years with no sign of deterioration.

How a Small Commutator Was Turned by an Improvised Method

BY R. L. HERVEY

Recently a rush order was issued to turn the commutator of a generator at a large country house. A turning rig was packed in an automobile and all hurried off for a long ride. One glance at the generator was enough to show that the rig would not fit. In the garage, however, a large engine lathe was found. This started an examination to determine whether the armature could be taken out and swung in the lathe, but this promised to be an uninviting job. While looking around the shop an angle plate was uncovered. This plate and the cross-feed of the small lathe were bolted together by a special screw of the rig. The plate was then bolted to the end plate of the generator frame, as shown in the accompanying sketch. There was but one bolt holding the angle plate on the generator frame, which made the equipment look very unsteady. A hole in the angle plate was selected so that, if the plate turned around the bolt, the tool would swing away from the commutator and not into it. The screw of the cross-feed was too short to take a cut across the commutator, therefore the tool had to be reset for each cut. This was a little troublesome, as the tool had to be tapped into position with a hammer. The commutator had grooves in it about ¼-in. deep, requiring considerable cutting. However, the job was satisfactorily done with this arrangement.



LATHE CROSS-FEED USED FOR TURNING COMMUTATOR

The generator was direct connected to a low-speed horizontal gasoline engine. While working on the commutator the valves were taken out to prevent compression, and the turning effort provided by a 1-hp. motor belted to the flywheel. The electrical equipment of the plant consisted of the generator and a storage battery of fifty-eight lead cells. These supplied current for the lights, a motor-driven ice machine, laundry, water-pump and machine tools in the garage.

MARKETING ELECTRICITY

A Department on Selling Service and Widening the Use of Electrical Energy

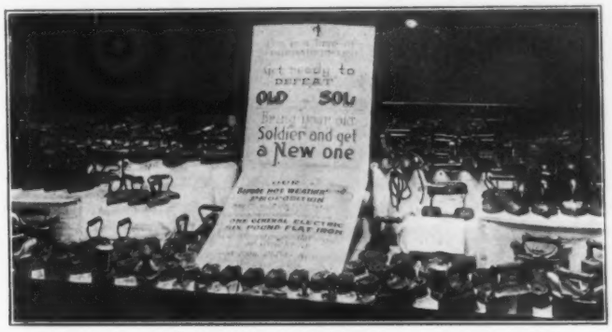
Twice As Many Irons Sold as There Are Customers at Greenfield, Mass.

BY ROY SCOTT COWAN

Contract Agent Greenfield Electric Light & Power Company

The accompanying window display shows the results of an electric flatiron campaign held by the Greenfield Light & Power Company this spring.

During the eighteen selling days of the campaign 198 old flatirons (variously of the gas, charcoal, gasoline and electric types) were brought in for exchange. These old irons not only made a window display that aroused curiosity and interest, but were afterward sold for 1 cent a pound. Twenty-five of the electric irons brought in were in good shape and will be used to replace irons which are being repaired. A single-sheet flyer was sent to each customer with his monthly lighting bill.



TWO HUNDRED OLD IRONS EXCHANGED FOR ELECTRIC UNITS AT GREENFIELD, MASS.

The contents of this hot-weather window display were afterwards sold to the local junk dealer at one cent a pound.

The results of the campaign have been gratifying to us, for we have already sold nearly twice as many flatirons as we have customers.

How Electricity Helped a Bankrupt Restaurant Man to "Come Back" to Business Success

Out at Glenwood, Iowa, in June, 1913, J. B. Mershon, a restaurant man, went bankrupt. He had worked hard but he could not make his restaurant pay. By the middle of October of 1914, however, he had acquired some more capital and a new idea about the restaurant business and he decided to try it again. This time, moreover, he determined to try it electrically. So he started what he called "Bernie's All-Electric Glenwood Cafe." Six months later he had secured practically all of the restaurant trade in town. A near-by rival had "shut up shop." Electricity had brought prosperity where coal and gasoline had failed.

That every operation in the new business was accomplished electrically is evidenced by the list of appliances and fixtures the store contained. (See Table I.)

Under the terms of the rate schedule of the central station company which supplies the energy, the restaurant pays a demand charge of $6 a month, in addition to 2.5 cents for the first 180 kw-hr. used, 2.25 cents for the next 180 kw-hr. used and 2 cents per kw.-hr. for all additional energy. A deduction of 10 per cent is made for prompt payment. With this rate the average cost of electricity is about 3 cents a kw.-hr. and the monthly bills, when 125 meals per day were being served, has ranged between $20 and $25. Experience in the restaurant business has taught the owner of the all-electric cafe, however, that these charges were very reasonable, for when he was using gasoline and coal his fuel costs were $35 a month, in spite of the fact that he was doing a smaller volume of business. Specific energy consumptions for typical months, together with the cost thereof, are given in Table II.

TABLE I—ELECTRICAL EQUIPMENT OF ALL-ELECTRIC RESTAURANT

	Watts
One three-burner hotplate	4,500
One electrically heated six-compartment steam table	880
One two-compartment warming closet	880
One popcorn machine with three units:	
Popper	1,500
Butter heater	880
Warmer	880
One five-gal. coffee urn with water jacket	880
One drink mixer	50
One cigar lighter	25
One coffee percolator	750
One electric iron	550
Two fans	100
One 24-in. pancake griddle	3,600
Total	15,475

TABLE II—MONTHLY ENERGY CONSUMPTION

Month	Kilowatt-Hours	
April	731	$21.97
May	639	20.13
June	819	23.73
July	809	23.53
August	855	24.45

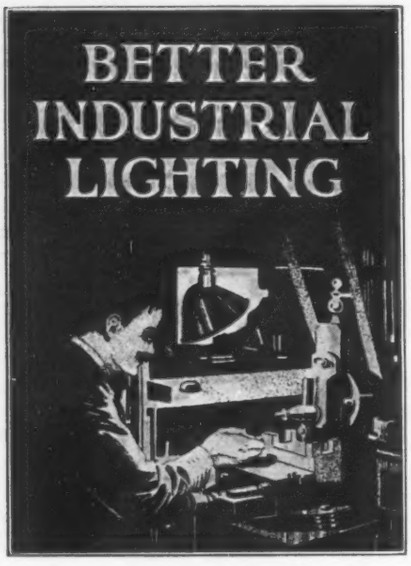
Besides popularizing electrically cooked meals in Glenwood and securing the bulk of the town's restaurant business, Mr. Mershon exercised an educational influence in surrounding towns for, as he puts it, "People who go through in autos never saw the like of it before, but I can answer their questions and show them that the all-electric way is cheaper for me."

THE ALL-ELECTRIC CAFÉ AT GLENWOOD, IOWA

Electric cooking enabled the proprietor to secure practically all of the restaurant trade in town, and this at a saving in comparison with former costs for coal and gasoline.

"The Need for Better Industrial Lighting" —A Booklet for the Factory Owner

The Commercial Section of the National Electric Light Association has just issued a new booklet entitled "Better Industrial Lighting," which is offered to central station companies as a means of educating present and prospective power customers in the improved illumination of their factories, plants and shops. The sixteen-page pamphlet is illustrated with a number of well-chosen pictures of representative lighting installations, and the text material supplies general information on shop lighting subjects, laying particular emphasis on the importance of good illumination as a factor in plant production. "It is evident," concludes the booklet, "that the design of a properly balanced lighting system is work for an expert. . . . There is need of sound illumination engineering judgment and experience. With such a vital relation between lighting and production, no painstaking efforts should be too great to insure yourself that your factory lighting is the best obtainable. It is worth while to call in a lighting expert just as you would call in an architect for the design of a new building.



COVER OF COMMERCIAL SECTION BOOKLET

"It will cost you little or nothing to find out what changes will be required to modernize your plant lighting system. Would you not like to know the cost, so that you can compare it with the increased production and decreased spoilage you may reasonably expect as a result?

"Stop the leak in your profits caused by poor illumination. Do not hesitate to seek advice to-day."

Imprinted with the name of the local central station company, the booklets are offered by the Commercial Section (N. E. L. A., 29 West Thirty-ninth Street, New York), at $35 per thousand; $20 for 500, and $12.50 for 250. Imprinted envelops may also be obtained at $5 per thousand.

Reduced Residence Rate to Secure Increased Summer Load

With the advent of the spring season, the rate for "domestic power" service in Saskatoon, Sask., has been reduced from 4 cents per kilowatt-hour to 2.25 cents per kilowatt-hour. This has been done with a view to increasing the summer load, according to Edward Hanson, electrical engineer for the city, as well as inducing the public to use electricity more extensively for household purposes during the summer off-load period. Since the new rate went into effect, it has been noted that many customers are becoming more interested in electric cooking appliances, etc., several new cooking installations having been made already.

"House-Wiring Month" Achieved Results Equivalent to One Year's Normal Growth at Waycross, Ga.

In reporting the experience of the Ware County Light & Power Company, Waycross, Ga., in its recent "Wire-Your-Home" Month campaign, R. E. Trexler, assistant treasurer of the company, has written to the Society for Electrical Development, Inc., as follows:

"When the 'House-Wiring Month' campaign idea was first suggested it did not seem worth while to undertake a special campaign in Waycross since the city was already being worked along this line. One of the local wiring contractors, however, urged us to assist him in a special campaign, and this we finally agreed to do by a limited amount of advertising and by offering as a special inducement for the month a standard electric iron, or its equivalent in value, for every already-built house wired during the month. Approximately $20 in prizes was also offered for (1) the high-school student writing the best essay on the use of electricity in the home; (2) the student turning in the largest list of house-wiring prospects; and (3) the student securing the largest number of contracts for house wiring. This $20 in prizes gave the campaign its "punch," creating free general advertising and interest.

"The net result of the campaign was the wiring of eighty-two houses, many of them occupied by owners who had lived all their lives without electric lights and who, perhaps, never expected to use them. This result may not seem so very good as compared with what is regularly accomplished in the average town of the same population—18,000—but in Waycross a good percentage of the population are negroes, and another big percentage live in rented houses which remain unwired because the owners will not wire them.

"We consider the result of the campaign in Waycross fairly good, being an increase of 7 per cent in the number of meters on our lines—almost as much as we would ordinarily have expected in a year. Moreover, it is the writer's belief that every old house wired secures automatically the wiring of an average of two more by suggestion and neighborly rivalry."

A Moving Window Display that Was Operated from a Sidewalk Switch

Sales of a popular sewing-machine motor were largely increased by the Tafel Electric Company of Louisville, Ky., through the aid of a window display, the feature of which consisted in carrying the foot-pedal switch out onto the sidewalk in front of the store. A sign on the window, with an arrow pointing to the foot pedal (which was made detachable so that it could be taken in at night), invited passers-by to start the machine. The demonstration attracted much attention and many people bought as a result. The sewing-machine motor sold for $15, and was also offered on easy payments at $16.50—$1.50 down and $1.50 per month.

Jobber's Stationery that Tells of Stock

The Northwestern Electric Equipment Company, jobber and manufacturer, St. Paul, Minn., has begun the practice of printing halftone illustrations of its jobbing establishment and manufacturing plant on the back of its letter paper. The photographs selected for the purpose are pictures which tell graphically the story of the company's large investment in stock carried to the end that the customer may be given efficient service.

Winning Friends and New Business in a Town of 4000

Sales Methods That Have Helped Double the Income per Capita in Two Years at Pauls Valley, Okla., as Told in a Paper Read Before the Oklahoma Convention on May 24

BY R. K. JOHNSTON
Manager Washita Electric Power Company

"When we first covered the town with irons we put out more than 100, and at the end of thirty days' trial, when we sent each of the users a bill, only six of the women called us to come after their irons. We selected the hottest Tuesday morning for the purpose, and two of these women sent their husbands down to get back their irons before the boy had returned to the office with them. Needless to add, the other four irons were eventually taken back also."

Pauls Valley is a town of about 4000 people. In getting new business we have had to overcome the prejudice of the people against the former operators, as two plants before the present one had been failures. The first plant had a 75-kw. generator and a threshing-machine boiler. As the load would come on in the evening the lights would grow dimmer, until finally the engineer would blow the whistle and shut down. After enduring this kind of service for some time, the citizens rose up in arms and cut the company's poles down.

This left the town without lights for some eighteen months, after which another promoter attempted to develop a water-power on the Washita River. He had the misfortune to locate his dams in a bed of quicksand. Just as the people were getting used to electric lights, out would go his dam and the town would be in darkness until he had repaired the damages. He had a very overbearing disposition and always pursued the policy of the "public be damned." The citizens were again holding mass meetings, getting ready to cut down his poles, when he sold the plant to Mr. Walker, who put in a part of the present steam plant, and was rapidly restoring public favor toward the electric light company.

These were the conditions under which we bought the plant some two years ago. The public had been so badly treated that it was rather antagonistic to the company, and very dubious about electric lights lasting. The first thing we did after taking charge, therefore, was to establish friendly relations with the public, for I believe that the obtaining of new business and the creating of a good feeling with the public, go right along together. We took off the meter rental of 25 cents, which had been a constant source of contention, and established a minimum of $1 per month.

We advertised extensively in the papers the advantages of electric lights and electrical appliances and urged our customers to bring all complaints direct to our office.

We then went out soliciting house wiring. For thirty days only, we offered an electric iron free with every house wired. Our regular price is $2 each for the first three outlets and $1.50 for each additional outlet. We secured some fifty houses that month.

I am a firm believer in campaigns for business. Make some special offer for a limited time, as it gives you something to start talking about, and you can press your prospective consumer for immediate action. I have also observed that people whom you cannot close with during the campaign, eventually come to you and want their houses wired. In fact we have invariably wired as many houses during the next few months *after* a special offer, as during the time of the campaign. Even if you cannot close the deal during the campaign, it gets them to thinking about electricity. I always solicit the occupants of tenant houses, even if I know there is no chance to get them as customers. It makes the tenants think about electric lights and dissatisfied with their present quarters. When I leave a tenant I always say to him "Well, when you move, be sure and see that the house is wired. Your landlord will wire before you move in and not afterward." Local advertising in a general way does not pay in a town of this size unless it is followed immediately with personal solicitation. We try to co-operate with any special campaign the manufacturers are making and take advantage of the free service they usually offer.

HOT WEATHER AS A SALES ALLY

Liberal free trial of any electrical device is one of the best ways to sell it. When we first covered the town with irons we put out more than 100, and at the end of the thirty days' trial when we sent them a bill, only six of the women called us to come after their irons. We selected the hottest Tuesday morning to go after them, and two of these women sent their husbands down to get their irons before the boy returned to the office with them. It is needless to add that eventually the other four irons were taken back by them. We now always install an iron when we set a meter, charging for it. This keeps our lines well saturated with irons without any extra expense. If an iron comes back we sell it for $2.50. We tried the thirty-day free trial on electric grills and stoves. About two-thirds remained in use and we were able to get people to try them who would not even talk to us about buying one. Last year we left fans on ten days' trial and called for them on a hot morning. Although last year was a cool summer we sold nearly as many as we did the year before. We will try the same policy again this summer.

From my experience I do not believe in cutting prices on electrical appliances, but believe in maintaining the list price and when necessary giving the customer liberal trial and easy payments. If you get a customer who wants something cheap, sell him a used article at a little above cost.

Our office is located up town and we try to make it attractive. We have sample utensils displayed on a large table where they can easily be handled by our customers when they come into our office to pay their light bills. Either the bookkeeper or myself are always at hand to explain the various electrical devices, and some of the best "leads" I get on new business have come either from my bookkeeper or from some of the men on the line. These prospects can usually be closed, if you follow them up promptly.

We now have five electric tailors' irons which we put on a 5-cent rate. Each iron is good for from $2.50 to $12 a month. To get these irons in I offered them at a price, installed, guaranteeing to take them out without a cent of charge if they were not satisfactory in every way. Not one has been returned. I firmly believe that

"This scheme I have always found successful. If a man is a drayman, wire his house and agree to take it out in draying. If he is a farmer living in town, let him bring in a load of hay. You may pay a dollar more than the hay is worth and get some bad hay, but you get a customer at the same time who will be on your lines long after the hay has been forgotten. . . . If you can convince a man that he will not be out any real money, he will usually go ahead and let you wire his house."

if we had asked these customers to take the chance of installing an electric iron we could not have persuaded them to consider using it.

We did the same with two electric coffee urns, installing them and guaranteeing them satisfactory in every way, energy consumption included. Then I agreed to take the price of these urns out in board. It is needless to add that those two urns are now paying my board, as one brings in from $5 to $7 a month, while the other runs about $10.

A LOAD OF HAY AS LEGAL TENDER FOR HOUSEWIRING

This scheme I have always found successful. If a man is a drayman, wire his house and agree to take it out in draying. If he is a farmer living in town let him bring in a load of hay. You may pay a dollar more than the hay is worth and get some bad hay, but you get a customer at the same time who will be on your line long after the hay has been forgotten. These have been hard years in Oklahoma and none of our people have been flush with ready cash. If you can convince a man that he will not be out any real money, he will go ahead and let you wire his house.

We have some 350 hp. in motors now connected to our lines, with about 200 more that will come on this fall. My idea on getting the larger installations is to cut just under what it costs them to make their own power, and the extra convenience of electric power will convert them to its use. On the smaller installations, if I cannot get them any other way, I offer a motor installation on a free trial basis. Since getting the principal industries to use central station energy the rest of the business comes easy, as they can see what the other people are doing. After a thorough investigation, the city voted to equip its pumping station with electrically driven pumps, finding electricity the cheapest power.

In getting new business we have not employed any unusual methods, only we have tried to keep the whole force enthusiastic about electricity. In fact, most of the ideas we have employed have been gathered from electrical journals. If we find a man who wants his house wired, we go right over and do not give him time to change his mind. We stop our outside work to look after complaints, as this is where the customer comes in contact with the company. He does not care if our poles rot down, so long as his little troubles are adjusted immediately. By pursuing this policy of prompt service, liberal trial and easy payments, we have built up a gross revenue from $3.50 to $7 per capita in two years.

Massachusetts Electric Railways as Central Station Power Customers

Thirteen Massachusetts central stations sold electricity to street railways last year, according to the thirty-first annual report of the Gas and Electric Light Commission, just published. The Connecticut River Transmission Company (now the New England Power Company) sold 28,348,216 kw.-hr. to street railways, and the Edison Electric Illuminating Company of Boston sold 10,514,701 kw.-hr. to traction customers. The Turners Falls Power & Electric Company sold 3,909,646 kw.-hr. to trolley roads; the Greenfield Electric Light & Power Company sold 3,319,310 kw.-hr. and the United Electric Light Company, Springfield, sold 1,024,000 kw.-hr. The Central Massachusetts Electric Company sold 1,346,527 kw.-hr. for traction service. Six other companies sold less than 1,000,000 kw.-hr. each to street railways. In all nearly 55,000,000 kw.-hr. were billed to the electric roads by the central stations.

Selling Power in Foreign Markets—How the Fulton (N. Y.) Company Is Advertising Afield for New Industries

A few years ago the marketing of electric power was looked upon as a local selling problem in which the opportunity was limited by the number of factories established in the community and offering an outlet for the utilization of electric motors. A campaign of advertising now being conducted by the Fulton (N. Y.) Light, Heat & Power Company, shows how greatly the influence of the modern power company has broadened and its opportunity for progress and prosperity increased. Through the recent completion of a large hydroelectric development which harnesses the Great

POWER
FOR YOU
TORONTO
LAKE ONTARIO
FULTON
ROCHESTER
BUFFALO
SYRACUSE
ALBANY
TROY
BARGE CANAL
NEW YORK
Great Falls of Oswego River.
Cheap and Plenty in Fulton, N.Y.
Large surplus of Electric Power, Water and Steam.
Transportation by rail and water.
Ideal labor market.
Good factory sites.
Terms interesting.
If You Need Power, And Want it at Once, Investigate This Opportunity at Fulton, N. Y.
By the completion of a new hydro-electric development, a large amount of power becomes available.
We have nearly 12,000 H.P. connected—6,000 ready to sell—more on short notice.
We have water at a head with dam and head-gates completed that will furnish large additional power.
We have for sale or lease an 1800 H.P. hydro-steam-electric plant located on the Barge Canal; also have available a new steam-turbine plant of 2300 H.P. on private switch to two railroads.
Fulton offers you exceptional advantages in an ample, stable labor market, good factory properties available, and unusual facilities for shipping your product. Three independent railroads—New York Central, Lackawanna and Ontario and Western—enter Fulton and provide 24-hour freight service to New York at cheap rates. Direct water transportation via Great Lakes and to Hudson River via State Barge Canal. Close to raw material markets.
We will sell you any part of this ready power on exceptionally favorable terms. Write today for detailed proposition.
FULTON LIGHT, HEAT AND POWER CO.
FULTON, N.Y.
NEW YORK CITY OFFICE · 42 · BROADWAY

NEWSPAPER ADVERTISEMENT TO INTEREST OUTSIDE MANUFACTURERS IN FULTON'S WATERPOWER FACILITIES

Falls of the Oswego River at Fulton, N. Y., the Fulton Light, Heat & Power Company has become possessed of a considerable surplus power; and there being insufficient immediate market for this power at home the company has instituted a campaign of advertising in the newspapers of New York and Chicago and in a number of trade magazines reaching industries for which Fulton offers advantages. The company is fortunately able to offer not only electric power connected, but complete plants which have been freed from service by the new water power and also a large additional capacity now flowing over the dam. Many inquiries are being received and there is prospect that a profitable market for the surplus will soon be developed.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Automatic Protective Devices for Direct-Current Systems

Advantages of Using an Automatic Selective Leakage Apparatus in Two-Wire and Three-Wire Distribution Systems—Arrangements for Three-Wire Circuits

AUTOMATIC protection against grounds has been given less consideration on direct-current systems than on alternating-current lines. M. Rosebourne and F. A. Couse discuss the direct-current case in an article in London *Electrician* of May 12, 1916, and state the advantages of automatic selective leakage devices in direct-current systems as follows: When overload circuit breakers only are installed, ground currents and consequently electrolysis and corrosion may arise. Such ground currents would flow continuously if below the value of the circuit-breaker setting. Where overload circuit breakers are installed, faults are automatically cleared only by the excessive currents necessary to open these breakers, practically resulting in short-circuits which disturb the whole system; furthermore, the overload breakers in the generating circuits are liable to open, and thus result in a complete shutdown. If leakage indicators be adopted, a complete or partial shutdown of the system becomes necessary, in order to localize the fault, unless the fault is left on the system until it can be tested under dead conditions.

The authors describe a number of devices which insure that a fault on a two-wire or three-wire system is immediately cleared without any disturbing currents flowing through the system. In all their arrangements a resistance is inserted between the busbars on the source of supply with a connection of the mid-point to earth. In the case of three-wire systems, it is proposed to insert a resistance between the outer busbars at the source of supply, and normally to ground a point on this resistance slightly removed from the neutral point in potential, so that a difference of potential exists between the middle wire and the point connected to earth, as shown in Fig. 1. Should a fault to earth occur on any of the three poles of any feeder, a current will flow in the earth connection, which operates the relay placed in this circuit. This relay is made to operate the contactor switches and to short-circuit part of the resistance opposite in potential to the pole on which a fault develops, which results in a momentary increase in the earth current sufficient only to create an unbalanced condition between the currents in the three poles, which are normally balanced, as shown in Fig. 2, and thus by means of the differential relay operate the circuit breaker in the faulty section and clear the fault. Immediately the fault is cleared and the circuit is automatically changed to its normal condition. The same effect may also be produced by automatically shifting the position of the earth point on the resistance to a

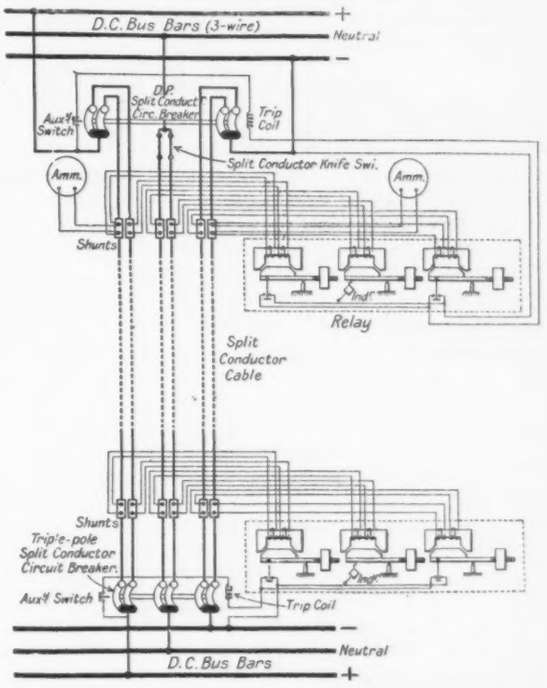


FIG. 3—AUTOMATIC PROTECTION FOR SPLIT-CONDUCTOR SYSTEM

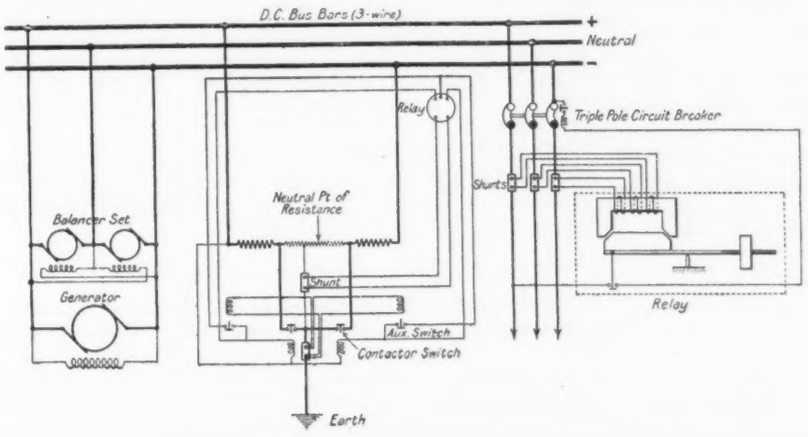


FIG. 1—RESISTANCE BETWEEN MIDDLE POINT AND GROUND

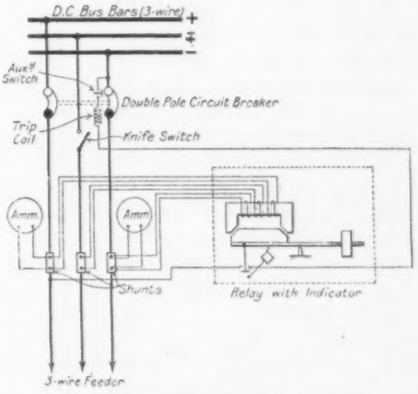


FIG. 2—OPERATION OF RELAY

point nearer the pole adjacent to the faulty pole as before, thus reducing the resistance in the circuit of the earth current.

This method may be applied to the split-conductor system, where a feeder may be energized from both ends, as shown in Fig. 3. In this case a resistance is inserted between the outers at the source as before, the conditions of grounding, etc., remaining unchanged. A fault on any branch to ground produces a current in the ground connection, and thus upsets the balance in the faulty feeder as before and trips the switch at both ends, the remaining part of the system being kept intact, since the balance is upset only in the faulty-feeder section.

This method of protection can also be adapted to alternating-current systems, where the resistance mentioned could be replaced by reactances.

Lamps and Lighting

Mercury-Vapor Pump.—Horatio B. Williams.—An abstract of a paper read before the American Physical Society. Gaede has described a new high vacuum pump whose action depends on the difference in the rates of effusion of mercury vapor and gases through a very narrow slit. The present author has constructed a very simple pump, which is much more rapid in action than the Gaede type and seems to be equally effective in producing extremely low pressures. The vapor passes through a constriction connected to the vessel to be exhausted. Within the connecting side tube is a small Hopkins condenser (see Fig. 4), whose cooling effect aided by that of external air condenses any vapor which enters before it has penetrated far. Diffusion takes place through the annular space between the condenser and outer side tube. This space is 2 mm. wide and has an area of about 1 sq. cm. A large Hopkins condenser above condenses the main stream of vapor. The auxiliary pump is connected to it near the top. By arranging to have the diffusion take place at a constriction in the main vapor flow tube, advantage is taken of the Bernoulli effect. It is thus made possible to have the vapor pass the diffusion point rapidly without reaching a lateral pressure so high as to cause it to pass far into the side tube. A lip projecting from the side tube into the main flow tube hinders the direct passage of vapor into the side tube. The eddies in the vapor stream which this obstruction produces probably hasten diffusion. As the gas which diffuses into the stream of vapor is rapidly carried to the upper condensation chamber, the usually slow process of diffusion becomes very rapid. The auxiliary pump should produce a vacuum of something like 0.1 mm. of mercury, but the pump will operate with a fore vacuum of 0.25 mm. Its action is then much slower. Two pumps in series operate rapidly with a fore vacuum of 0.25 mm. The mercury may be heated with a small open flame, or preferably with a small electric oven. Effective action does not depend so critically upon precise regulation of temperature as in the Gaede type. A thermometer built in is unnecessary. Preliminary experiments indicate that the exhaustion is even more rapid than with the molecular pump. A single pump with a May-Nelson oscillating ring pump as auxiliary exhausted a 2-liter bulb with large aluminium electrodes from atmospheric pressure to a point where the alternative spark gap measured 18 cm. in seven minutes. Two vapor pumps connected in series and sealed directly to a MacLeod gage reduced the pressure from approximately 0.25 mm. to 4×10^{-6} mm. in four minutes. A short time later the pressure was too low to be measured.—*Phys. Review*, May, 1916.

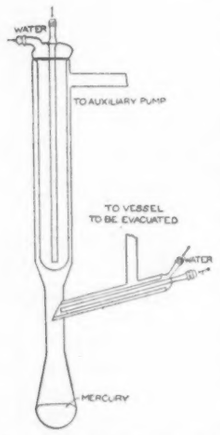


FIG. 4—MERCURY PUMP

Generation, Transmission and Distribution

Power Transmission from Sweden to Denmark.—An illustrated article on the use of a submarine high-tension cable for power transmission from the generating plant on the Lagan River in Sweden to the electricity and street railway company in Hellerup, near Copenhagen, Denmark. From the power plant on the Lagan River in Sweden the overhead transmission line at 50,000 volts extends to the transformer station near Helsingborg, where the voltage is reduced to 25,000. From there an underground cable of 4.8 km. (3 miles) extends to the switchhouse on the Oresund, where the submarine cable begins. It ends on the Danish side at Marienlyst, and from there an underground cable of 1.5 km. (1 mile) extends to the transformer station at Steinorlt. The submarine cable is a three-conductor cable, insulated with impregnated paper, of 3 x 70 sq. mm. copper cross-section, and is operated at 35,000 volts. It has a length of 5.4 km. (3¼ miles). About 200 m. to the north of the high-tension cable and parallel to it a heavily armored gutta-percha cable is placed, which is used as a telephone cable and at the same time serves as a protection to catch any anchor of a ship which might endanger the high-tension power cable. To the south of the high-tension power cable and parallel with it there are three telegraph cables. In view of the present difficulty of procuring coal the Danish company is quite satisfied with this supply of energy from Sweden, although for the present only 370 kw. is imported. This amount is, however, to be largely increased in the future.—*Elek. Zeit.*, March 30, 1916.

Horizontal Luffing Crane with Balanced Jib.—A detailed illustrated description is given of a compensated derricking crane with balanced jib, which differs little in external appearance from a crane of the ordinary type, but which shows a considerable saving in power consumption.—London *Electrician*, May 5, 1916.

Shipyard Cranes in Rotterdam.—M. G. de Gelder.—A long abstract of a paper presented before the (British) Institution of Naval Architects. The author briefly describes the several crane systems for the handling of material over the building slips at shipyards and gives a detailed description of an electric crane which may be considered a combination of the traveling tower crane and the cantilever crane. These cranes have been installed at a shipyard in Rotterdam, and full particulars of their performance are given.—London *Electrician*, May 12, 1916.

Insulation Faults.—H. Behrend.—A mathematical article on the influences of insulation faults on leakage currents and capacity currents in three-phase transmission lines.—*Elek. Zeit.*, March 2, 1916.

Installations, Systems and Appliances

Rotary Converter Installation.—E. P. Austin.—An illustrated article describing a special case in which different systems, namely, a direct-current traction load, a direct-current three-wire lighting load, a three-phase system at 50 cycles, and a three-phase system at 30 cycles were linked together by means of a rotary converter installation.—London *Elec. Review*, May 5, 1916.

Starting and Controlling Electrical Machinery.—C. C. Garrard.—The conclusion of his illustrated mathematical article on apparatus for starting and controlling electrical running machinery. The discussion of the deter-

mination of the total external resistance per phase is concluded and the author then discusses the grading of the rotor resistance, both for starting and for speed control.—London *Electrician*, March 24, 1916.

Wires, Wiring and Conduits

Service Branches from High-Tension Circuits.—D. M. MACLEOD.—In large transmission systems the investment in the transmission and distribution network per kilowatt may exceed the cost of power house and generating plant per kilowatt, and an efficient and economical mains layout becomes of utmost importance. When a supply is required for a large power consumer there is seldom any question as to its being obtained from or incorporated with the nearest available ring main, even should the consumer's works be situated some distance therefrom, as the importance of the supply is such as to justify the capital expenditure involved in looping in the ring-main circuit and providing the necessary substation and balanced protective equipment. In some cases, however, a comparatively small supply for an isolated works may be all that is required, and in such cases a single high-tension branch service from a switchhouse situated on the route of the ring-main cable may be all that is needed. By so doing, the cost of a loop-in can be saved; but unless the route length of the service is fairly large this advantage is largely discounted, if not entirely eliminated, by having to equip a switchhouse at the point of junction. The following table gives some indication as to the percentage cost of various methods of delivering a supply of, say, 100 kw. to a point 1 mile from the line of route of a ring-main cable, it being understood that the point of supply is so far removed from any transforming station that a low-tension service line is not considered to be economically practicable:

(a) Cost of looping-in ring-main cable, auxiliary cables, and consumer's substation equipment	$100
(b) Cost of laying branch cable and auxiliary cables, building and equipping switchhouse, and equipping consumer's substation	64
(c) Cost of laying branch cable and auxiliary cables, link box, and equipping consumer's substation	53

The percentages are calculated for underground cables in each case. In the case of (a) overhead transmission is not admissible, as the expense of a double line built in accordance with (British) Board of Trade requirements and accepted modern practice would show to very little advantage compared with underground cables laid in a common trench. Overhead transmission is, however, often quite admissible in the cases of (b) and (c) and if adopted would make the percentage cost of these two methods still more favorable. These figures show at once the economy in first cost in using branch services controlled from an extra high-tension link box at the point of junction. Details are given in the paper of the design of link boxes which connected to 11,000 circuits have proved quite satisfactory in practice. An account of the discussion which followed is also given.—London *Electrician*, April 28, 1916.

Electrophysics and Magnetism

Selenium.—KATHRYN JOHNSTONE DIETERICH.—An account of an experimental investigation of the effect of temperature on the resistance, the light sensitiveness, and the rate of recovery of certain crystals of metallic selenium. The resistance in the light and in the dark is, in general, decreased by increase of temperature, with a small increase in some cases in the region 0 deg. C to 50 deg. C. The coefficient of recombination is not constant at all temperatures, but decreases with increase of temperature in much the same manner that the coefficient of recombination decreases in gases with increase in temperature. Over a wide range of temperatures the rate of recovery for the first few hundredths of a second is proportional to the conductivity in the light. The sensitiveness of light does not vary greatly over a wide range of temperature, although a tendency toward a maximum is found in the region 30 deg. C. to 50 deg. C. —*Phys. Review*, May, 1916.

Ionization by Collision.—K. T. COMPTON.—The first of a series of mathematical papers on the theory of ionization by collision. In this paper the author studies the distribution of velocities of the ions in a gas under various conditions. In some gases the electrons start approximately from rest after each collision, while in others their kinetic energy is retained except at collisions which result in ionization. These cases are called inelastic and elastic impact respectively, and are considered separately as well as the case of ionization in a mixture of elastic and inelastic gases.—*Phys. Review*, April, 1916.

Units, Measurements and Instruments

Synchrono-Phosphoroscope.—An abstract of an American Physical Society paper. In the study of the phosphorescence of substances the flow of which is of brief duration, particularly where it is desired to investigate the changes of intensity of color due to heating or cooling, it is convenient to be able to deal with substances of considerable size. For this purpose the authors have devised and constructed the following apparatus: The object to be examined is viewed (Fig. 5) through the

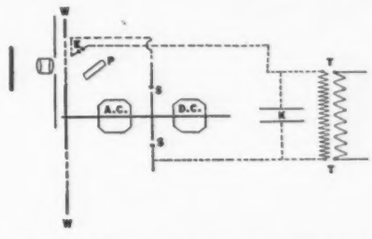


FIG. 5—FEATURES OF PHOSPHOROSCOPE

open sectors of a revolving disk, *WW*, which is mounted on the shaft of a synchronous alternating-current motor, *AC*. The number of open and of closed sectors equals the number of poles of the alternator, and the excitation of the object being examined is by means of a spark or series of sparks, *E*, or of a suitable vacuum tube, actuated by means of a step-up transformer, *TT*, on the same alternating circuit. By proper adjustment of the disk, excitation occurs during the intervals when the phosphorescent surface is behind the closed sectors and the surface is visible for successive intermediate intervals. On a 60-cycle circuit with four sectors these intervals are of 1/240 of a second each, and may begin 0.001 of a second or less after the excitation ceases. By breaking the sparking circuit the subsequent decay of materials of long duration may be observed without stopping the disk. By means of a direct-current motor, *CC*, on the same shaft, which ordinarily serves to bring the synchronous motor to speed, the disk may be driven at other speeds, the excitation in these cases being timed by means of a four-point star wheel, *SS*, on the shaft so as to occur regularly during the passage of the closed sectors. By the use of this device the authors have found it possible to take photographs in color by the Lumiere process, showing the change of color of various phosphorescent sulphides during decay, and the effect of low temperatures on the color and intensity of these substances. They have also made detailed comparisons of the spectra of the uranyl salts during and after the close of excitation, and have determined the rate of decay of the phosphorescence of these salts.—*Phys. Review*, May, 1916.

C. J. RUSSELL

Charles J. Russell, who was re-elected vice-chairman of the Commercial Section, N. E. L. A., at the recent convention at Chicago, has been manager of the sales departments of the Philadelphia Electric Company for the last twelve months, following a period of service covering many years with the Philadelphia central station organization and its associated suburban companies. Mr. Russell first entered the employ of the old Manufacturers' Electric Company of Philadelphia in 1891. In 1909 he was awarded the first Doherty Medal for his paper on "Diversity Factor, Load Factor and Power Factor," and in 1912 he received honorable mention for his paper on "Corporations."

John O'Connor, formerly of Joplin, Mo., has been appointed superintendent of the Massillon (Ohio) Electric & Gas Company, to succeed A. V. Wynne.

Ransome W. Davenport, for the last four years engineer of the Detroit Stove Works, Detroit, Mich., has been appointed assistant to the president of the Jeffery-DeWitt Company of Detroit.

Grattan Kerans, who for four and a half years has been associate editor of The Jovian, the organ of the Jovian Order, on June 1 returned to the editorial staff of the St. Louis Post-Dispatch.

Thomas H. Bibber has resigned as general sales manager of the Adams-Bagnall Electric Company, Cleveland, Ohio, and has been appointed sales manager of the Luminous Unit Company, St. Louis, Mo.

A. V. Wynne, formerly superintendent of the Massillon Electric & Gas Company, Massillon, Ohio, has been appointed general superintendent of the Mansfield Electric Light & Power Company, Mansfield, Ohio.

J. A. Campbell, who has been stationed at Dallas, Tex., since 1910 as chief engineer of the Dallas Electric Light & Power Company, will leave immediately for Buffalo, N. Y., to take charge of the construction of a large plant for the Stone & Webster Engineering Corporation of Boston, Mass. **James Orr,** formerly chief engineer of one of the company's Florida properties, will succeed Mr. Campbell in Dallas.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

T. R. Harber has been appointed purchasing agent of the Kansas City Light & Power Company. Mr. Harber has been associated with the company for the last thirteen years in the meter and engineering departments.

Claude A. Kittredge, superintendent and engineer of the Bangor Power Company, of Milford, Me., has been promoted to the position of superintendent of the Bangor Power Company and the Orono Water Company.

George W. Dietrick, vice-president and treasurer of the Prince George Electric Light & Power Company of Hopewell, Va., has been appointed president of the company to succeed H. D. Eichelberger, who recently resigned.

Abbott A. Laughton, who has been local manager of the Gardner (Mass.) Gas, Fuel & Light Company and the Athol (Mass.) Gas & Electric Company, has been promoted to the position of district manager of these companies.

Charles Klapper, formerly electrical engineer for the Toltz Engineering Company, St. Paul, Minn., announces that he is now engaged in consulting practice of electrical and mechanical engineering with offices at 408 Oppenheim Building, St. Paul.

H. E. Dawson has been appointed contract agent for the Metropolitan Electric Company of Reading, Pa. For the last five years Mr. Dawson has been with the Edison Lamp Works of the General Electric Company, at Harrison, N. J., in advertising and general campaign work.

Edward I. Williams has been appointed manager of sales of the National Electric Heating Company, Ltd., of Toronto, Canada. Mr. Williams, who has been in electrical work for twenty years, was during the last four years with the Simplex Electric Heating Company.

Edward Huff, formerly with the Ohio Light & Power Company of Tiffin, Ohio, has resigned to assume the position of superintendent of the municipal electric-light plant at Pendleton, Ind. Mr. Huff has been with the Tiffin plant four years and with the American Gas & Electric Company for thirteen years.

Henry W. Trumbower, assistant professor of political economy at the University of Wisconsin, Madison, has been appointed a member of the Wisconsin Railroad Commission to succeed Halford Erickson, resigned. Mr. Trumbower was born in 1882 and is a graduate of Lehigh University. Later he took a special course in political economy at Princeton and at the University of Munich. His term of office began on June 1 and will end next February.

C. H. KRETZ

C. H. Kretz, the president-elect of the Gas, Electric & Street Railway Association of Oklahoma, is the general manager of the Okmulgee (Okla.) Ice & Light Company. Mr. Kretz is a native of Louisiana and was educated at his State university and at Cornell. Upon graduation at the latter institution he was commissioned an engineering officer in the United States Navy with the rank of ensign, and served during the Spanish-American war. In 1899 he was appointed assistant professor of mechanical engineering at Louisiana State University and served the institution for seven years as a member of its faculty. The next four years were spent as the manager of the Baton Rouge Electric & Gas Company, Baton Rouge, La., and later Mr. Kretz was appointed manager of the Beaumont (Tex.) Traction Company, resigning to come to Okmulgee two years ago.

Dr. Willis R. Whitney, director of the research laboratory of the General Electric Company at Schenectady, N. Y., has been awarded the Willard Gibbs medal, founded by William A. Converse of Chicago, Ill. The presentation was made on May 19, at the time of the meeting of the Chicago section of the American Chemical Society, when Dr. Whitney made an address on "Incidents of Applied Research."

Obituary

Louis B. Schneider, president and general manager of the Tecumseh (Mich.) Light & Power Company, was killed in an automobile accident in Detroit on May 30, when his car skidded on a wet pavement.

Le Baron Carleton Colt, vice-president and general manager of the National India Rubber Company of Bristol, R. I., died on May 25 as a result of injuries received in an automobile accident on the preceding Thursday, when his companion, Albert S. Chesebrough, the famous yacht designer, was instantly killed. Mr. Colt was graduated from Brown University in 1899 and was appointed resident manager of the National India Rubber Company in 1904.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Electrically Operated Music Optigraph

B. F. Miessner, a student of electrical engineering at Purdue University, La Fayette, Ind., with the assistance of W. O. Miessner, director of the School

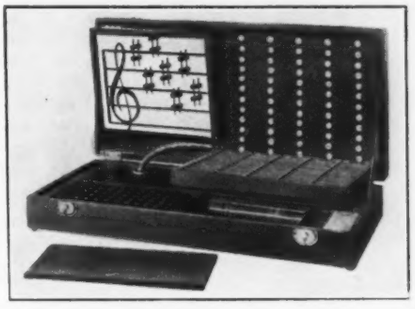


FIG. 1—THE MUSIC OPTIGRAPH OPENED TO SHOW THE WORKING PARTS

of Music in the Milwaukee State Normal School, has perfected what authorities on music teaching believe to be a complete solution of the difficulties encountered in the practical teaching of motif-wise reading of music. The apparatus by means of which the solution has been accomplished is a device for instantaneously flashing note groups on a screen by means of manually operated push buttons and miniature electric lamps. The range of the instrument is an octave and a half. Motifs containing any number of notes up to five may be flashed by pressing the lettered push buttons corresponding to the notes desired. The push buttons are of special design to produce the light touch necessary when several are operated simultaneously. They are contained within

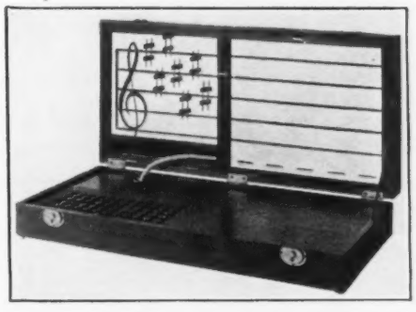


FIG. 2—MUSIC OPTIGRAPH READY FOR OPERATION

a space sufficiently small to facilitate easy operation, the experience gained by typewriter manufacturers being used as a guide in this particular matter.

The staff lines are printed on a dull, semi-transparent sheet of pyrolin or celluloid, behind which are situated the miniature electric lamps of the flashlight type. The notes appear on the lines and spaces of this staff as solid ovals of red light when the push buttons are pressed. The red notes combined with the plainly visible lines of the staff, the dull white celluloid background, and the scientifically chosen proportion of these parts, tend to minimize the purely physiological difficulties of rapid visualization.

The instrument, which has been named the "Miessner music optigraph," is self-contained in a mahogany case which measures 20 in. by 12 in. by 5 in. and weighs about 15 lb. The two parts of the case are hinged like a dress suit case, the upper part containing the staff and its illumination equipment, and the other portion containing the push buttons, batteries, etc. The music optigraph is said to permit of a great reduction in time expended by music teachers, and at the same time provides a practical method of teaching by the motif-card method.

Talking-Machine Motor

The "Veeco" electric drive for talking machines has recently been brought out by the Victor Electrical Equip-

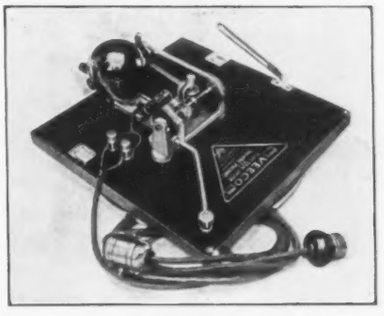


FIG. 1—ELECTRIC DRIVE IN PLACE OF USUAL SPRING TALKING-MACHINE MOTOR

ment Company, 248 Boylston Street, Boston, Mass. The outfit, it is asserted, can be permanently installed in any talking machine in about five minutes. In installing the outfit the crank of the talking machine is first removed and the board holding the spring motor is then taken out; next the board holding the electric drive is put in place, the connecting cord run through the crank hole and connection finally made to the electric circuit. The motor for driving the talking machines is of the universal type and can be provided for any pressure from 6 volts to 250 volts. Fluctuation of current, it is pointed out, does not affect the tempo or pitch. The speed of the motor can be varied from 20 r.p.m. to 120 r.p.m and can be started and stopped at will when the cover is closed by a switch in the cord. This makes it very useful for dancing and particularly for instruction work,

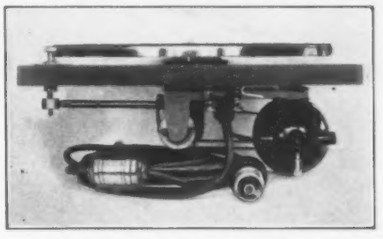


FIG. 2—SHOWING ELECTRIC DRIVE UNDERNEATH TALKING-MACHINE TURNTABLE

as a special cord can be supplied of any length to allow the instructor to control the machine from any position in the room. By merely holding the edge of the turntable one can change the record without shutting off the current. In cases where the talking machine is removed to places where electric energy is not available, the spring motor can quickly be replaced.

Electric Blackboard Eraser Cleaner

Removing chalk from blackboard erasers by pounding two of the erasers together has always been a tedious and unpleasant task. The advent of an

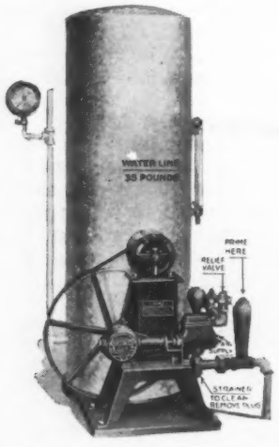
CLEANER FOR REMOVING CHALK FROM BLACKBOARD ERASERS

electrically operated cleaner designed to remove the chalk dust from the erasers should, therefore, be hailed with considerable interest by various teachers and their pupils. In the accom-

panying illustration is shown the "Dumore" eraser cleaner recently placed on the market by the Wisconsin Electric Company, Racine, Wis. The outfit is essentially a small-sized vacuum cleaner, suction being produced by a 1/25 hp. universal-type motor. Not only is a strong suction provided for removing the chalk dust, but a rotating bristle brush is also utilized to clean the surface of the eraser. The chalk dust is drawn into the box and the air is filtered through a fine muslin separator. No chalk escapes into the room, it is asserted. All metal parts of the device are nickel-plated and the cabinet work is of hardwood, finished in mahogany. The cleaner may be operated from any convenient lighting socket and is provided with 10 ft. of reinforced cord and attachment plug.

Electric Water System for Residences

The residence water system made by the Burnett-Larsh Manufacturing Company, Dayton, Ohio, and shown herewith, consists of a single or duplex, double-acting pump, with motor, and a tank. It is used for automatically pumping soft or rain water from cistern to bathroom, kitchen and laundry, under pressure, and has been developed to fill the demand for a reliable, small outfit for residence service to take the place of water motor pumps and water lifts. The price of the outfit is practically the same as a water motor pump or water lift and, the manufacturers claim, it can be used to advantage at extremely low cost in even the smallest homes. The outfit is practically noiseless in operation. The pump is belt-driven by a Westinghouse motor operating on direct current or single-phase alternating current with heavy-duty overload starting characteristics, and designed especially for pump service. There are four sizes of pumps used with capacities of 100, 160, 200 and 360 gal. per hour, requiring 1/12-hp., ⅛-hp., 1/6-hp. and ¼-hp. motors respectively. The tanks furnished are either black or galvanized and have capacities from 40 gal. up. The vertical suction lift of the pump is 22 ft. The system is entirely automatic, the pump starting when the pressure in the tank falls to 22 lb. and, by means of an automatic electric switch, stops at a maximum pressure of 35 lb. In order to provide the necessary air pressure an air-pumping device is furnished. The pump is also equipped with a suction strainer to prevent pipe dope, scale, dirt and foreign matter from getting into the pump and fouling the valves. The outfit is furnished mounted on a heavy cast-iron container base. Connections from pump to tank, and between pump, switch and motor are made. It is only necessary to connect the suction to the cistern, the service pipe to the house fixtures, and the wires to the lighting circuit. Then by turning a switch the system can be put in operation and will thereafter automatically furnish all the water necessary for regular residence use.



AUTOMATIC ELECTRIC HOUSE PUMPING OUTFIT

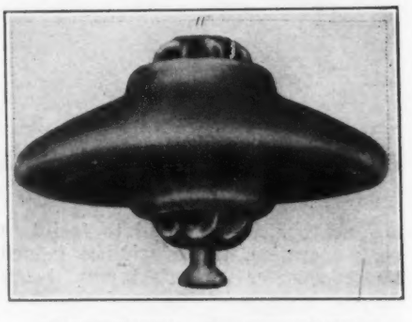
Electric Dishwasher for Restaurants

A recent addition to the list of labor-saving appliances for hotels and restaurants is the variable-speed, submerged-type dish washer, made by the Fearless Dish Washer Company, of Rochester, N. Y., shown herewith. The machine consists of a metal wash tank in which a cradle is supported on two parallel loops which are swung forward at one speed and back at another speed. This is accomplished by a specially designed variable-speed mechanism which is preferably driven by an electric motor. Adjoining the wash tank is a metal rinse tank filled with boiling water. In this tank all trace of wash water is removed and the dishes are heated so that they quickly dry when removed. The above-named concern also makes a line of metal and metal-lined tables that help the operator to work efficiently, and a scrapping block for removing the refuse from dishes. The block is set in a hole in the table above the garbage can. The operator takes a dish in each hand and strikes them on edge on the rubber ring with which the block is equipped. The inertia of the refuse carries it down through the block into the garbage can. The two dishes are then placed in a wire dish basket, lined with wood and specially designed to prevent nesting or breaking the dishes. When the basket is full it is placed in the cradle in the wash tank and worked by the electrically operated mechanism until the dishes are clean. This takes from twenty to thirty seconds. While this basketful is being washed, the operator packs another basket. He then takes the first basket out of the wash tank and puts it into the rinse tank, puts the second basket into the wash tank and packs the third basket, and so on. The dishes are washed by the variable wave motion of the water. Cups, mugs, bowls and glasses are washed in a special basket which provides a separate compartment for each piece. This insures perfect cleansing and draining and prevents breakage of handles. The machine can be made to receive dishes at the right and discharge them at the left or vice versa. It can also be arranged with two wash tanks and one rinse tank, two rinse tanks and one wash tank, or one wash tank, one rinse tank and a covered rinse tank for sterilizing. The capacities of the different sizes are from 2000 to 8000 dishes per hour, depending upon the skill of the operator. The tanks can be heated by steam coils, steam jets, gas burners, gasoline burners or kerosene burners.

VARIABLE-SPEED SUBMERGED-TYPE DISH-WASHER

High-Tension Porcelain Insulator

The Jeffery-Dewitt Company of Detroit, Mich., manufacturer of porcelain spark plugs, has recently brought out a high-tension, suspension-type insulator which is said to differ considerably from those now on the market. The distinguishing features of the device are the great thickness of dielectric, and the balanced field of stress due to the identical metal electrodes above and below. The dielectric thickness is 2.25 in., which is claimed to be much greater than that of any other single-piece unit now in use, and the stress on the porcelain under all operating conditions is said to be correspondingly lower than on the thinner types. The usual rigid malleable-iron caps and solid pins are replaced by two spider-shaped caps, the legs of which are set into the porcelain to a depth of 1 in. on the upper and lower sides of the insulator. Each leg is cast with a foot; by giving the cap a slight turn after placing in the holes provided in the insulator, these feet clamp into the porcelain and the space around the legs is filled in with a special



HIGH-TENSION SUSPENSION-TYPE INSULATOR

alloy similar to that used in die casting. No cement is used on the insulator. This alloy, as applied, does not shrink away from the porcelain, it is claimed, and has a very low coefficient of expansion. It is also asserted that the insulator can be plunged from boiling to ice water without harm. The flexibility of the legs prevents expansion and contraction strains on the poreclain, and this construction is intended to absorb shocks and distribute the tensile strain uniformly.

The ultimate mechanical strength of the insulators is claimed to be from 8000 to 10,000 lb., and the electrical properties are said not to be affected in the least up to the full breaking strain, the electrical and mechanical strains occurring at entirely different parts of the porcelain.

Authorities have proved that insulating materials gradually fail under stresses which cause corona. The critical stress varies with the specific inductive capacity of the material, and for porcelain, the safe potential gradient is about 40,000 volts per inch of thickness. Tests of the Jeffery-Dewitt insulator have shown that on both normal and high frequency, corona is avoided up to 90,000 volts and even 110,000 volts, due to the unusual thickness of dielectric. It is also claimed that the balanced field is very important in securing the full value of the insulating material and enabling the insulator to resist high frequency and other line conditions caused by lightning and switching.

Low-Priced Electric Range

Included among the electric ranges recently placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is the Type 406 range which deserves special attention, the maker points out, because its low price puts it within reach of the family of small means. This range compares favorably in appearance, it is declared, with some of the more expensive ranges manufactured by the Westinghouse company. The oven has two heaters and is equipped with racks and broiling pans and is large enough to do ordinary baking. The sides and top are lined with two layers of asbestos separated by dead-air spacing, while the bottom and door are packed with mineral wool. This heat insulation is of course not so good as that on the more expensive ranges. There are no thermometer or automatic-control features.

RANGE WITH OVEN AND TWO 8-IN. HEATERS

The range top has two 8-in. heaters each of 1000 watts rating, placed a sufficient distance apart to allow the use of ordinary cooking utensils without crowding. The finish is a high-grade black enamel, attractive in appearance, which protects the surface from rust. The ovens are treated with a special aluminum finish baked on at a high temperature which not only prevents rusting but by reflecting the heat increases the efficiency of the oven. The range measures 31.5 in. long, 16 in. wide and 31.5 in. high. The oven is 16 in. long, 12 in. wide and 11.5 in. deep. A special high back can be provided if desired.

Soot Cleaners

Hand soot blowing is not only a disagreeable and dirty job, but it has been demonstrated, and it is now generally conceded, it is declared, that even with boilers that can be blown by hand with reasonable thoroughness the efficiency is about 5 per cent poorer than where a mechanical soot cleaner is installed. Hand blowing is also becoming increasingly dangerous on large, high boilers with high pressures and temperatures.

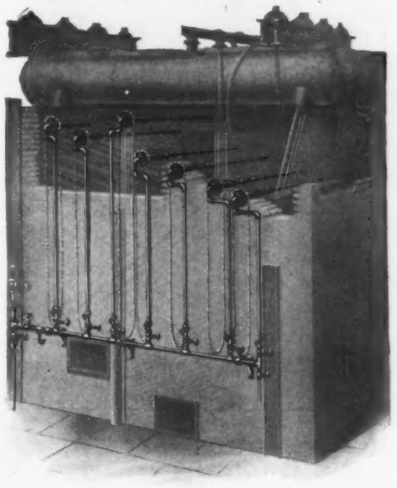


FIG. 1 — SOOT CLEANER APPLIED TO BABCOCK & WILCOX BOILER

The fundamental requirements for efficient soot cleaning may be set down as follows: (1) Frequent cleanings so as to remove soot and ash in its primary or nascent form; (2) the combined use of powerful steam and gas currents; (3) the concentration of these currents successively on each part of the surface to be cleaned. The first of these requirements is a matter of operation. The application of the second and third of these principles on two types of boilers, as equipped with soot cleaners by the Vulcan Soot Cleaner Company of Du Bois, Pa., is illustrated in the accompanying illustrations.

For boilers of the Babcock & Wilcox type with horizontal tubes and vertical baffling, the fundamental principle consists in directing powerful steam jets along the diagonal paths at about 60 deg. to the horizontal. The cleaner element is mounted on bearings and rotated by a chain and sprocket wheel outside the setting, so that the jets

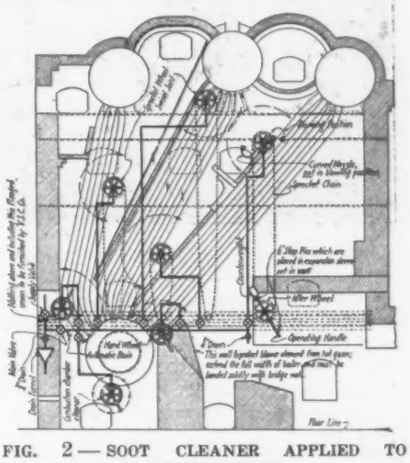


FIG. 2 — SOOT CLEANER APPLIED TO STIRLING BOILER

of steam discharged from the nozzles arranged longitudinally of the elements are caused to sweep through a wide arc, concentrating their cleaning and scouring action successively on each portion of the tube surface. The complete installation on a Babcock & Wilcox boiler is shown in Fig. 1, where the location of the elements for each of the passes, and also for the superheater, is such as to insure concentration of steam-gas currents set up by the discharge of steam from the nozzles, on all parts of the heat-absorbing surface. A main steam header is installed along the length of the boiler with risers and valves for each element, as shown. Operation of the cleaner consists in opening the valves on each riser in rotation, commencing at the left. Cleaning every six or eight hours is generally the best practice. Two important features of the soot cleaner, the manufacturer points out, are the anti-corrosion air relief valves and the telltale drain valve, the former located on each of the risers and the latter on the main steam header.

The soot cleaner as applied to a Stirling boiler is shown in Fig. 2, the special features of this installation being the elements for the first bank where the temperatures are high and proper precautions must be taken to avoid burn out.

Wood Pole Reinforcing

The Harding Pole Concreting Company of Spokane, Wash., has perfected and patented a process for reinforcing wood poles which have been weakened at the ground line by decay. With this system it is first necessary to remove the earth around the pole to a depth of about 4 ft. The rotted portion of the

POLE REINFORCED WITH CONCRETE

pole is then removed and the healthy wood surface thus exposed is treated with a preservative which will prevent the pole from absorbing moisture. Sixty-penny spikes equipped with stamped metal clips are then driven into the pole. The reinforcing rings and stay rods, which are made of ⅜-in. corrugated iron bars, are placed around the pole and are supported by the spikes. A collapsible steel form is then placed around the pole so that its interior rests against the heads of the spikes and the concrete is poured into this form. It is stated that the process of placing the form on the pole can be very easily completed in eight minutes. When the concreting process is nearing completion, a narrow piece of rubber belting or some other such elastic material is placed in the concrete at the point where the top of the concrete would otherwise touch the wood. When the job is finished this piece of belting is removed, and the open space left in the concrete is then filled in with a waterproof compound which permeates the wood and effectively seals the joint.

The advantages claimed for this process are first, that the concrete will not crack, since waterproof paint prevents the pole from absorbing moisture and thus expanding, and second, that the steel is arranged for maximum strength. The cost of installing this type of reinforcing will, of course, vary with local conditions, but it is stated that the Kootenai Power Company, Ltd., of Cœur D'Alene, Idaho, has applied it to 500 poles with an average cost of $16.50 per pole. It is stated further by the manufacturers that the Washington Water Company and other Western concerns are contemplating the use of this process in spite of the fact that they are in the cedar-producing country.

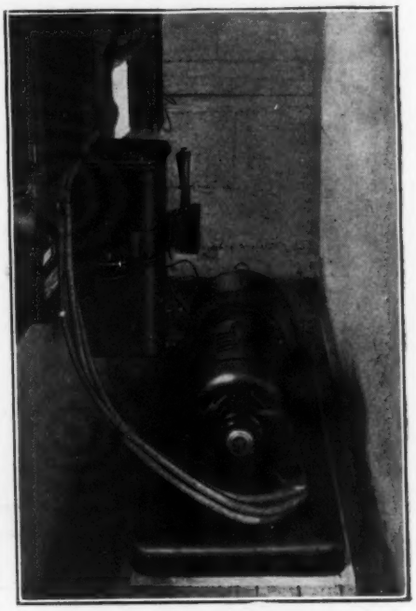
Pole-Top Gin

A pole-top gin, which was especially designed to meet certain demands in the erection of steel cross-arms frequently used on wooden poles, and which has also been found useful in line work where heavy apparatus must be lifted and supported on wooden poles, is shown herewith. It has been found especially convenient for use in handling transformers on poles either in new installations or in replacements. As an aid in general maintenance work, the manufacturer points out, it means a saving in time and labor. It can also be satisfactorily used in the replacement of poles, since it obviates the need of a special pole hoist and a gang of erectors. The pole gin, which has been placed on the market by the Railway & Industrial Engineering Company, Pittsburgh, Pa., consists of a main base fitted with four spurs and a chain and lever for clamping it to the pole. The tackle may be suspended from the arms at the top. To attach the pole gin, the lineman jabs the lower spurs into the pole as he would a spear; then the top of the channel is thrust toward the pole and the upper supports sink into the wood. In this position, it is declared, the gin will "stay put" while the handle is opened, and the chain carried around the pole and linked into the catch. The handle is then closed, causing the chain to bite into the pole. In its closed position the handle is self-locked. If the chain is too loose and does not bite into the pole firmly enough, the handle is opened, the chain disengaged from the catch and lengthened out one link; then it is pushed up at the back of the pole and the handle is closed again. As the load is placed on the gin the lower spurs bite into the pole further and become firmly placed. When the work is finished the device may be readily detached. The gin is designed to carry a load of 1500 lb.; in cases of emergency it may carry one of 2000 lb., it is claimed.

POLE-TOP GIN FOR LIFTING STEEL CROSS-ARMS AND OTHER HEAVY APPARATUS

Motor-Generator Set for Motion Picture Theater

In order to obtain a clear, steady light for the operation of motion picture machines it is necessary to have direct current, since with alternating current the arc has a tendency to flicker, is difficult to focus, and requires more current. Therefore, where only alternating current is available, means must be provided for converting this current into suitable direct current. The management of the Orpheum Theatre, Allentown, Pa., having to depend upon an alternating-current supply circuit, recently installed a 4⅛-kw., two-light, motor-generator set made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This set, illustrated herewith, converts three-phase alternating current to direct current at 75 volts. As only 55 volts through the arc is required, however, the generator voltage is reduced to this potential by means of non-inflammable, well ventilated, grid-type resistors having ten steps for adjustment. This leaves the operator free to concentrate his attention on the adjustment of the lens and the projection of the picture, as no difficulty is experienced in adjusting and holding the arc. The motor operates on the regular three-phase supply circuit. The generator is of the commutating-pole type, being compound wound and flat compounded, in order that a constant voltage may be maintained irrespective of the amount of energy used. Ballast resistors in series with the lamp tend to maintain a constant current through the arc. A two-light set was installed in order that, when a two, three or four-reel picture was being run, one reel could be "faded in" on a second machine simultaneously with the "fading out" of the reel on the first machine. This is done without varying the voltage.



TWO LIGHT MOTION-PICTURE MOTOR-GENERATOR SET

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

New Hydroelectric Plant Under Construction in Maine

Construction work has been well started on the new 20,000-kw. hydroelectric station of the Cumberland County Power & Light Company on the Saco River, near Hiram, Me., and it is hoped to complete the first 3000-kw. of the installation's equipment before next winter. The entire work is being done by the Cumberland company. It includes the building of a concrete dam with a 290-ft. spillway and a maximum height of 30 ft., with provision for 4.5-ft. of flashboards, a 450-ft. wooden penstock 11 ft. in diameter, and a section of the power house, with Allis-Chalmers generating unit and governor. An auxiliary hydroelectric plant of 125-kw. rating is to be installed for temporary service during the construction period. The temporary plant will utilize a portion of the full head, and will consist of a generator belt-driven by a 22-in. turbine, the latter being served by a 54-in. temporary penstock. The generator will be installed later in one of the company's smaller stations. The initial unit of the main plant will include a vertical type turbine operating under a head of 80 ft. Energy will be generated at 2300 volts and stepped up to 38,000 volts in an out-door substation. The latter will include Westinghouse transformers, switches and remote control, the entire plant being operated from a benchboard in the main station. A steel tower line with spacing and insulation suitable for 66,000-volt service will be built between the Hiram station and the Bonny Eagle station of the company, 16 miles downstream. The towers will be of the A-frame type, spaced from 400 to 500 ft. apart, and square anchor towers will be erected every mile on the line, as well as at angles. The tower will be designed for two circuits, only one of which will be installed at first. About a dozen motors will be used in the construction plant.

H. L. Doherty on Regulation

Governmental regulation of public utility affairs has had much to do with the failure of the electrification of railroad terminals in Chicago, according to the view expressed on May 23 by Henry L. Doherty, who addressed the Illinois Manufacturers' Association at the Congress Hotel, Chicago, Ill. Mr. Doherty, whose subject was "Governmental Attitude Toward Public Utilities," also stated his belief that drastic regulation of railroad or other utilities would always have a depressing effect upon general business conditions.

"We are passing through a period of great prosperity," said Mr. Doherty, "but it is to a certain extent abnormal, and eventually we must go back to normal conditions. A consistent prosperity is impossible, due to the attitude of the government toward public utilities. This attitude, of course, is but a reflection of the people generally, and is usually antagonistic. The great trouble appears to be that most of the people labor under the belief that a corporation should have no financial returns other than the interest rate, and consequently nothing has been done in the last few years by railways, interurban lines or electric and gas companies. Moreover, these utilities will not expend more money until they are certain of the government's attitude.

"One consequence of this public view is that people will travel over the country roads in buggies at a cost of from 15 cents to 20 cents a mile instead of 3 cents a mile, as they might do did conditions encourage the building of additional steam and electric railways.

"It is this public belief that the interest return is sufficient for a corporation that has prohibited the electrifying of the railway systems of the United States, and that, I understand, is the situation much sought for in Chicago."

Public Service Commission News

New York Commission

Where the maximum rate for natural gas is restricted to 40 cents per 1000 cu. ft., by the terms of a municipal franchise granted to and accepted by a gas company, a "minimum charge" of 50 cents for such gas service is unauthorized, it was held by the Public Service Commission for the Second District, and cannot be justified by the commission, because, by analyzing such minimum charge, it appears that, by enforcing the same, the company might thereby exact a maximum charge greater than the amount prescribed by the franchise. The commission approves and authorizes a fixed monthly service charge of 50 cents applicable to all customers, which will include all items of expenditure by the company in holding itself in readiness to serve such customers, and will also cover all gas used during the period for which such charge is made.

Missouri Commission

The Public Service Commission held, in regard to a complaint against the Consumers' Power Company, that an individual consumer using electric service for business and residence consumption at the same premises is entitled to have the service measured upon a single meter and to the benefit arising from the rate being based upon the combined consumption; and as the cost of furnishing electric service to consumers so situated upon a single meter is less than the cost of furnishing the same to individual business and residence consumers at separate localities, it does not amount to unlawful discrimination. Where electric service is furnished an individual for business and residence consumption at the same premises upon a single meter the maximum monthly minimum charge for business consumption is considered proper.

Washington Commission

In the fifth annual report of the Public Service Commission for the year ended Nov. 30, 1915, the inspector of tracks, safety appliances and electrical construction stated as follows:

"The amount of electrical construction and rehabilitation during the last twelve months has increased and violations decreased. This is owing to the fact that all concerned are becoming more familiar with the interpretation of the law and its requirements. While some

rules should be changed, there have been but few deaths and injuries caused to men engaged in the actual performance of their duties, and such have not been due to faulty construction.

"Rule 12 should be amended to read as follows:

"In all span wires used for the purpose of supporting trolley wires of series arc or incandescent lamps there shall be at least two circuit breakers, one on each side of lamp or trolley wire, located not less than 4 ft. and not more than 6 ft. distant from lamp or trolley wire; and in the case where the span wire is attached to building or metallic poles additional circuit breakers shall be maintained at the buildings or at the poles: Provided, That on span wires which support two or more trolley wires no circuit breaker shall be required in span wire, between any two trolley wires: Provided further, That in trolley span wires attached to wooden poles only the circuit nearest to the trolley wire or wires shall be required."

He also made the following recommendation:

"Ground wires should not be run vertically on poles having transformers, fuse boxes or cut outs, but should be run on the adjacent pole. This will eliminate the danger while working in the above apparatus of coming in direct contact with ground wire."

Contending that a rate return of 7.6 per cent is insufficient for a public utility under certain conditions, the Superior Court of Thurston County, Washington, has reversed a decision of the Public Service Commission in the case of the Everett Gas Company's electricity rates in the city of Snohomish. The commission found the fair value of the property was $60,000, and on this the company earned net $8,314, or about 14 per cent. The highest primary rate was 12 cents per kilowatt-hour, which the commission reduced to 8 cents. The company appealed to the court, which found that the commission had failed to take into consideration that the company would be required to spend in the neighborhood of $2,250 during each of the next two years to comply with the Washington overhead line construction law.

The judge stated that such costs could not be considered as property charges. The court also found that nothing had been allowed for obsolescence; and then reviewed the matter of general interest rates in the State, showing that various city and other governmental obligations paid from 6 to 8 per cent, and that farm mortgages paid as high as 10 to 12 per cent, and with these the utility had to compete for funds. The court stated that these were "unhampered by regulative control as to amount and kind of security to invest the transaction with unquestioned certainty," and that considering the risks, hazards and vicissitudes of utility business, that the decision of the commission did not allow enough return.

Illinois Commission

In the matter of the application of the Lake Forest Water Company for a rehearing of a rate case the commission denied the prayer of the petition and reaffirmed its belief in the rule established by the Supreme Court of the United States to the effect that the rates established by a regulatory commission should be tried out for at least a year, before any attempt is made to disturb the commission's original order fixing the said rates. The commission states:

"This commission is not unwilling, after the rates prescribed in its order have been tried for at least a year, to permit the respondent to show the actual effect of such rates upon its revenues, as well as its operating expenses during the same period; and the commission would not then refuse to make any readjustment of the rates which appear from such showing to be necessary."

In several recent complaints, originating in East St. Louis, the commission ordered substantial reparations of electrical accounts, where it was shown that the utility had billed under superseded, obsolete or non-effective schedules and rules not at present filed with the commission, such schedules and rules resulting in an overcharge to consumers under the schedules in force at the present time.

The extent to which the State Public Utilities Commission investigates the property, records and accounts of a public utility engaged in a justification of its rates of charge, and the time allowed for compiling data, are indicated in the preliminary order entered in the case of the City of Moline versus Peoples Power Company. The commission ordered "that the Peoples Power Company shall prepare and file with the commission a carefully compiled and complete inventory, unpriced, of all its physical property, now used and useful in the rendering of gas and electric service in the city of Moline and in the immediate contiguous territory which is normally served from the same distribution system, within the periods of time set forth as follows:

A complete inventory of all electric power plants and electric substation equipments, within forty-five days; a complete inventory of all buildings and lands occupied by electric property, within sixty days; a complete inventory of the entire electric distribution system and of the electric utilization equipment, within seventy-five days; a complete inventory of the remainder of the electric property, within 105 days; a complete inventory of the gas distribution system, including meters and services, within forty-five days; a complete inventory of all buildings and lands occupied by gas property, within sixty days; a complete inventory of all gas plant and gas manufacturing equipment, within seventy-five days; a complete inventory of the remainder of the gas property, within 105 days.

"That the Peoples Power Company shall prepare and file (in triplicate) with the commission, within ninety days after service of this order, the statements listed as follows: Latest balance sheet—gas and electricity segregated; income account for the past five years, with supporting tables showing in complete detail the operating revenues, operating expenses and taxes; cost of property to date, including replacements and retirements, listed by years from the inception of the utilities, as far as it may be possible to ascertain the same from records; moneys received from the issuance of securities.

"That the Peoples Power Company shall prepare and file with the commission, within 120 days after service of this order, the consumer data listed as follows: Total consumption, or sale, of both gas and electricity, separately, for as many years as there exist records of the same; total manufacture, or plant output, of both gas and electricity, separately, for as many years as there exist records of the same; complete and detailed statistics of all consumer data, covering both gas and electricity, separately, for the fiscal year ending July 1, 1916; summary for the past five years, separately, of wholesale gas sales, retail gas sales, electric power sales, electric commercial lighting sales, electric municipal street lighting sales, electric residential lighting sales, electric flat-rate sales, electric sales to other utilities, etc.

"That the Peoples Power Company shall report at regular intervals, not to exceed thirty days apart, the progress that is being made toward the completion of the inventory and statements required by this order, and shall state definitely in said report the 'percentage complete' of each of the sections of work outlined hereinbefore."

Awards of Panama-Pacific International Exposition.—Replying to recent inquiries from this office, Mr. Fernbach, secretary of the Panama-Pacific International Exposition, advises us that the awards made by the juries will not be announced publicly for about two months yet.

Would Light Statues of Noted Men at Cleveland, Ohio.—Individual members of the Electrical League at Cleveland, Ohio, have for the past week been discussing plans for lighting the statues of public men located in various parts of the city. This idea originated through the proposition to light the Statue of Liberty in New York harbor.

Dayton Linemen Strike.—Twenty linemen employed by the Dayton (Ohio) Power & Light Company struck on June 1, on account of dissatisfaction over wages. The company, in a statement regarding the matter, announced that a voluntary increase from 40 to 42½ cents per hour had been granted on May 1 to first-class linemen. The discontent arises out of the fact that some of the men feel that they have been discriminated against. The company states, however, that it has no important work on hand, and that its service will not be affected in any way.

Poor Lighting Costs Wisconsin $300,000 Annually.—Adequate lighting in Wisconsin factories would mean a saving of $300,000 annually in accident costs, according to a letter sent to all the factories in Wisconsin recently by the Wisconsin Industrial Commission. Based on a study recently made by an insurance company of 90,000 accidents occurring in industries, it was discovered that 23.8 per cent were indirectly caused by inadequate lighting. Applying this experience to Wisconsin, about 3000 accidents would have been prevented each year if factories were properly lighted, thus effecting a saving of $300,000.

Juniors of Electrical Engineering Department of Case School Visit Large Electrical Plants.—Last week twenty-five members of the junior class of Case School of Applied Science, Cleveland, started on an inspection trip through sixteen of the largest electrical industrial plants in the country. They were conducted by Prof. Henry B. Dates, head of the electrical engineering department. The plants visited are as follows: Niagara Falls Power Company, Acheson Graphite Company and the United States Light & Heating Company, Niagara Falls; Rochester Railway & Light Company, Rochester; General Electric Company, Schenectady; General Electric Company, Pittsfield; Western Electric Company, Electrical Testing Laboratories Company, American Telephone & Telegraph Company, United Electric Light & Power Company and New York Edison Company, New York; Raritan Copper Works, Perth Amboy, N. J.; United States Light House depot, Tompkinsville, N. J., and the United States Bureau of Standards and the United States navy yard, Washington. They are to complete the trip on June 11.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Better Industrial Lighting.—An illustrated booklet entitled "Better Industrial Lighting," showing the economical and ethical advantages of good industrial lighting, has been prepared by the National Electric Light Association for distribution to industrial institutions by central stations.

Tax on Electric Shop Appliances.—All stock carried by the Milwaukee Electric Railway & Light Company in its electric shop will be taxed in addition to the other taxes levied on the corporation. It was held by the authorities that the tax was legal since the company's articles of incorporation do not specify lighting fixtures and heating appliances.

Hurley Becomes Chairman of Federal Trade Commission.—The Federal Trade Commission on Wednesday decided to adopt the practice of the Interstate Commerce Commission with regard to the chairman of the commission, and observe annual rotation in the election of its chairman. Pursuant to this decision Commissioner Edward N. Hurley has been selected by vote as chairman to succeed Joseph E. Davies. Mr. Hurley, who before the assumption of his national duties was prominently identified with the electrical manufacturing industry in Illinois, takes the office of chairman of the commission very well qualified. His years of practical study of national trade problems has given him a very broad and comprehensive viewpoint. In the electrical industry and elsewhere he is highly regarded both personally and as a business man, and it is the consensus of opinion that his work as vice-chairman of the commission has been exceedingly fruitful.

May License Electricians in Tacoma.—An ordinance has been introduced in the Tacoma, Wash., Council regulating the installation and repairing of electric wiring, providing for licensing and registering electricians, and the appointment of an electrical inspector and assistants. The following are some of the provisions in the ordinance: A written permit must be obtained for all electrical work; only a licensed electrician can be employed; permits for electric signs must be obtained. The ordinance does not apply to private electric lighting and heating plants, but work done in wiring must be by licensed electricians. The license fee for an electrician is $1 and for firms or those doing job work $50 per year. The latter must take out a surety bond of $1,000. All money received for inspection and license fees is to go to the inspection fund of the light department. Violations are punishable by $100 fine or thirty days in jail.

Electric Flag Waves in Illuminated Field.—The stars and stripes waving in an illuminated field at the top of the Illuminating company's building has caused much comment at Cleveland, Ohio, dunring the past few days. Six large reflector lamps are used to produce the illuminated field in which the flag waves.

Louisville Dealer Sells More Than 1500 Irons in Three Months.—The electric flatiron campaign conducted by the Tafel Electric Company, Louisville, Ky., during the last three months, has resulted in the sale of 1538 irons. On page 829 of the April 8 issue of the ELECTRICAL WORLD there is described in detail the methods employed by the company in conducting this campaign.

Strike of Inside Wiremen at Canton.—About forty inside wiremen employed by Canton, Ohio, electrical contractors struck last week for a closed shop, and several concerns found their business virtually at a standstill in consequence. The contractors declare that no concessions will be made on the point, however, and that the men will remain out until they are ready to return to work on their former terms.

Wisconsin Raises Taxes on Public Utilities.—The Wisconsin State Tax Commission assessed the property of street railway companies and light, heat and power companies operated in connection with them in Wisconsin at $62,688,000 and levied $824,764 taxes on them. Both the assessment and the amount of taxes are slightly larger than those of last year. The State gets 15 per cent of the taxes and the municipalities in which the taxed property is located get 85 per cent of them. The rate of taxation, which is the average one paid on all other taxed property in the State, is $13.1726 per $1,000 of valuation.

California Company Retrenches.—A plan of economy of operation to keep within the operating charge as laid down by the California Railroad Commission when they revised the rates of the San Joaquin Light & Power Corporation has been worked out by officials of the corporation, and the first two steps to cut expenses have been to suspend the publication of the San Joaquin Light & Power magazine and to abolish the system of monthly collections through ten collectors, who also adjusted complaints. Commencing the first of June all bills of the company will be mailed to the consumers and payment will be made either at the office or by check. A demand for the payment of the bill, accompanied by notice that service will be discontinued at the end of fifteen days if payment is not made, will be made to every consumer. "The State Railroad Commission," said A. G. Wishon, general manager of the company, "fixed a sum under which they think we should operate and make a reasonable profit on our investment. We are going to try to do this and it is necessary to dispense with certain departmens. Financially the magazine has not been a success, and we therefore will cease its publication after the May issue."

Chicago Electric Club — Jovian League.—Ex-Senator William E. Mason addressed the members of the Electric Club—Jovian League of Chicago on June 1. His topic was "Real Patriotism."

West Virginia Public Utilities.—The annual convention of the Public Utilities Association of West Virginia will be held at the Chancellor Hotel, Parkersburg, W. Va., on July 12, 13 and 14. W. C. Davisson, Charleston, W. Va., is secretary.

Dallas Electric Club.—Fred A. Jones, vice-chairman and secretary of the board of directors for the State of Texas organization for Industrial Preparedness, spoke on "Industrial Preparedness" at the June 2 meeting of the Dallas Electric Club—Jovian League.

Cleveland Electrical League. — Leon B. Bacon addressed the Electric League of Cleveland on June 2 on "The Balkan States and What They Mean to Europe." The annual meeting and banquet of the club was held on June 8. The annual picnic is scheduled to be held on June 15.

Rochester Section A. I. E. E.—"Theory and Practice of Electric Welding" was the subject of a paper by J. H. Bryan of the Westinghouse Electric & Manufacturing Company, before a meeting of the Rochester section of the American Institute of Electrical Engineering, in the Sibley Building on May 26.

Milwaukee Electrical League.—The Milwaukee Electrical League has elected the following officers to serve during the ensuing year: President, H. J. Meyer; first vice-president, Philip Polacheck; second vice-president, Conrad Voose; secretary, O. M. Rau; assistant secretary, Oscar Werwarth; treasurer, Charles Milne.

Baltimore Company Section N. E. L. A.—The Consolidated Gas, Electric Light & Power Company of Baltimore section of the National Electric Light Association, has elected the following officers: Chairman, W. Harry Cassell; vice-chairman, Thomson King; secretary, David C. Bruce; treasurer, W. A. Zimmerman; executive committee, H. M. Huth, R. H. Lang, J. E. Kane and A. L. Penniman.

Cincinnati Electric Club.—At a recent meeting, the Cincinnati Electric Club elected the following officers to serve for the ensuing year, after a warmly contested fight between two tickets, the "Amperes" and the "Volts": President, C. M. Crofoot; first vice-president, L. T. Milnor; second vice-president, T. J. Creaghead; secretary-treasurer, O. B. Marsh; directors, T. J. Ryan, W. W. Freeman and Walter Draper.

Kansas City Jovian League.—John H. Lucas, president of the Kansas City (Mo.) Light & Power Company, addressed the Jovian Electric Club of Kansas City on May 19. He declared that the interests of the city and the utility were mutual; and that the company would interpose no obstacles to investigations by officials or citizens, that the public might know how and why it was getting its service, and that the company might learn if there was any way to improve it.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Dayton Company Section, N. E. L. A.—About seventy-five employees of the Dayton Power & Light Company attended the regular meeting of the Dayton Company Section N. E. L. A. on June 1, and heard addresses dealing with the recent Chicago convention. Among the speakers were Thomas F. Kelly, commercial manager; O. E. Howland, assistant secretary and treasurer; O. B. Reemelin, general superintendent, and J. C. Matthieu, power engineer.

Los Angeles Technical Societies.—The annual joint meeting of the technical societies of Los Angeles was held on June 1. The subject under discussion was "Preparedness," and the following were the speakers: George W. Dickie of the California Auxiliary to the Naval Consulting Board; W. H. Booth, Security National Bank; Earle Remington, president, Aeronautical Society; Capt. Richard Park, United States Army; Capt. Charles T. Leeds, United States Army (retired).

Chicago Section.—I. E. S.—Instead of having its regular monthly meeting, the Illuminating Engineering Society, Chicago Section, accepted the invitation of the Commonwealth Edison Company Section of the N. E. L. A. to attend the Commercial Section meeting on May 25, at which the papers on "Highway and Municipal Lighting" by T. F. Kelley of Dayton, "Industrial and Yard Lighting" by Oliver R. Hogue, and "Lighting By-Product or Buy-Product" by William A. Durgin were presented.

Lynn Section, A. E. E. E.—The annual meeting of the Lynn section of the American Institute of Electrical Engineers was held on May 24. L. A. Hawkins delivered an address on "The Schenectady Research Laboratory," devoting his time particularly to explaining some of the more recent developments on the field of research. At the election which preceded Mr. Hawkins' address the following officers were chosen to serve during the ensuing year: Chairman, Gordon M. Campbell; secretary-treasurer, Morris B. Carroll; executive committee, F. H. Bowman and F. W. Mace.

Richmond Electrical Society.—After several preliminary meetings the electrical contractors, dealers and manufacturers of Richmond, Va., have organized the Electrical Society of Richmond with twenty-two charter members and the following officers: President, H. W. Hall of the Western Electric Company; vice-president, George H. Black of the Chesapeake & Potomac Telephone Company; secretary-treasurer, J. B. Dunn. The home of the new society is room 611 of the Virginia Railway & Power Building, which the house committee has just furnished. The society held its first meeting in its new quarters on May 17.

Iowa Electrical Contractors. — The following officers were elected at the recent convention by the Iowa Electrical Contractors' Association to serve for the ensuing year: President W. L. Fowler, Cedar Rapids; vice-president, Arthur Chandson, Muscatine; secretary-treasurer, Mark T. Humphrey, Waterloo; director for three years, Edward Kunkle, Davenport. C. H. Keller of the Keller Electric Company, Dubuque, was elected national committeeman. The appointment of a permanent secretary was favorably considered by the association and a committee was appointed to make arrangements with a suitable person to handle the work. The association voted to eliminate the next regular semi-annual meeting and in its stead have an executive meeting to which all members are to be invited.

Minnesota Engineers Form Joint Engineering Board.—The engineers of Minnesota, believing that through the co-operation of the various engineering societies they can be more useful to their communities, are forming the Minnesota Joint Engineering Board. The societies represented on the board are Minnesota section of the American Institute of Electrical Engineers, the Northwestern association of members of the American Society of Civil Engineers, Minnesota section of the American Society of Mechanical Engineers, Minnesota Surveyors and Engineers' Society, the Engineers' Club of Minneapolis, and the Civil Engineers' Society of St. Paul. It is hoped that through the joint organization the activities of the engineers of Minnesota may be more closely correlated with the result that more can be accomplished for the public welfare. George W. Pathjens of St. Paul is secretary.

Convention Cruise of Michigan Section, N. E. L. A.—Owing to litigation involving the steamer Rochester, on which the Michigan Section of the National Electric Light Association had planned to conduct its annual convention, it has been necessary to replace that boat with the steamer Arizona and make a few changes in the itinerary. The plan as just announced by H. Sylvester, Rochester, Mich., secretary of the section, is as follows: Steamer Arizona will leave Grand Haven at 1 p. m., on June 18, and arrive at Parry Sound at 5 a. m., on June 20. The delegates will leave Parry Sound at 7 a. m. the same day on the Steamer Waubick and journey to Penetang, which will be reached at 12.30 o'clock in the afternoon. They will reimbark at Penetang on the steamer Arizona at 1 o'clock and arrive at Sault Ste. Marie at 1 o'clock in the afternoon of June 21. After spending two hours at the latter point the steamer will make for Grand Haven again, which will be reached at 3 p. m., on June 22.

FINANCE, COMMERCE AND INDUSTRY

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Vacuum Cleaner Sales Above Normal

Volume of Business Rapidly Increasing with Prospects for Continuance Bright—Prices Higher—Deliveries Good—Collections and Credit Excellent

There is at present a strong, healthy demand for electric vacuum cleaners both of the stationary and the portable types. The volume of orders booked is very much above what would be considered as a normal business, and prospects for future orders seem very bright.

Better business conditions started early last fall and have been gaining in momentum ever since. One prominent manufacturer has not only just doubled his plant, but expects shortly to double the newly increased plant. The majority of manufacturers of electric vacuum cleaners are enjoying a record business in this line.

To a large extent this business is the direct result of the educational program that has been carried out by both the manufacturers and the local distributors. It is a comparatively new business, and the prospective buyers have had to be educated to the use of the appliance. With the return of general business prosperity, which carried along with it an abnormal demand for labor at abnormally high wages, the number of prospective purchasers increased manifold.

There has also been an increased demand on the retailers which has found expression in their orders from the producers or jobbers which is seasonal. Each year springtime finds a larger number of women who are no longer willing to endure the task of housecleaning with brooms and carpet beaters, etc., when there are simpler means at hand at a very moderate cost.

With but few exceptions the price of vacuum cleaners has advanced. Practically all of the materials involved in the construction of a machine have about doubled in price, and as a result the user must pay more. The greatest advance in raw materials was probably that of the price of aluminum, which has been very widely used in cleaner construction. A movement in which some manufacturers are participating has been started to substitute a less expensive material for the high-priced aluminum in an endeavor to keep the price to the user from advancing. It is not probable, however, that prices have advanced to the same extent as the cost of the raw materials. The increasing output of the manufacturers has enabled them to employ quantity production methods and thus keep down the cost of manufacture of the individual appliance.

Deliveries are generally good. Most manufacturers had stocked up on materials sufficiently far ahead to enable them to meet increased demands for their products without delay. Those manufacturers, on the other hand, who did not anticipate this buying movement by laying in sufficient stocks have been greatly handicapped. Aluminum castings, copper, tubing for handles, fiber, etc., that ordinarily could be had in a few weeks now can be had only by waiting many months. There have been some manufacturers, however, who have been making delayed deliveries who have adequate stocks of raw materials on hand. The difficulty here is one of production. Orders are coming in faster than the finished product can be turned out.

Credits and collections are everywhere said to be excellent. There is little or no difficulty in collecting accounts promptly. With business as good as it is there is the natural tendency to be more strict with credits and this undoubtedly has a great deal to do with the better condition of collection. Where the credit is not of the very best, a cash payment is demanded in advance of delivery and there seems to be no hesitation on the part of the buyer in accepting this condition.

While the producers of electric vacuum cleaners will not make any prediction regarding the future or what should happen on the termination of the war there is everywhere manifested an attitude of optimism. It is the general feeling that the demand will go even higher. Should the cessation of hostilities bring about a sharp decline in the prices of the raw products it is believed that the result will be a still greater demand for cleaners which will serve to further decrease the cost, etc.

Electrical Exports During March

Exports of electrical goods of American manufacture during the month of March last, according to the monthly summary of the Bureau of Foreign and Domestic Commerce, amounted to $2,884,875, or some $60,000 less than those for the record month of February. In comparison with March, 1915, the exports during the third month of 1916 showed a gain of about $1,225,000, or 77 per cent.

Unlike most of the preceding months, there were not many surprising gains in exports by articles. Motors to the value of $473,771 were exported during last March in comparison with $166,648 in March, 1915, while the exports of telephones and material jumped from $53,066 to $180,534 in this period. Miscellaneous items showed up well, the exports being $1,372,408 in March, 1916, as against $587,363 in March, 1915.

Insulated wire and cable exports and also exports of interior wiring supplies, both of which as a rule have been running way ahead of the corresponding month a year previous, were but slightly greater in March last than in the previous March. Exports of insulated wire and cable during March, 1916, compared well with previous months, but the exports for March, 1915, were very much greater than for earlier months. Exports of interior wiring supplies for March, 1916, were very much less than the average for several months.

In a number of items there were decreases in March, 1916, exports, compared with March, 1915, respectively, as follows: Batteries, $166,041 and $157,497; generators, $236,305 and $72,022, and fans, $20,533 and $18,376. Exports in the first two items have been running behind for some time, but exports of fans have been as a rule larger than those for the previous twelve months.

March exports brought the total for the first quarter up to $8,148,308, as compared with $5,119,176 for the first three months of 1915. This is an increase of more than $3,000,000 for the period, or 59.5 per cent.

Based on the figures for the first quarter, exports of electrical goods during 1916 should come up to $32,500,000, or the largest twelve months' exports of electrical goods of American manufacture in the history of the industry. The exports during the three preceding years were as follows: 1915, $24,308,510; 1914, $19,963,115; 1913, $28,197,363.

For the nine months ended with March, 1916, the exports were $21,466,055. This is larger than the exports for the similar period ended March, 1915, by almost $8,000,000, or 55 per cent, and larger than the similar period ended March 14 by more than $1,500,000, or 8.5 per cent.

It is doubtful, however, if the exports for the nine months ended March, 1916, were larger in quantity than for the nine months ended March, 1914. On the other hand, it is more than likely that they were less. In fact, it is very uncertain that the large monthly values being placed to the credit of American exporters of electrical goods represent any appreciable quantity increase.

A study made of the exports month by month shows that the largest increases were as a rule in the exports of those articles that have advanced most in price. There is one instance that can be referred to in March that emphasizes the point very well, namely, insulated wire and cable.

Copper wire was quoted at 15.87 in March, 1915, and 29.50 in March, 1916, an increase of 13.63, or 86 per cent. Insulation advanced as much if not more during the same period, so that under the assumption that insulated wire and cable advanced 86 per cent during the year the value of the March, 1916, exports in this item alone should have been $440,000, to have been equal in quantity to the $236,849 of March, 1915. Instead these exports amounted to only $269,606.

Apparatus using copper appliances requiring insulation, or using steel—in fact, almost everything of electrical manufacture—during the past year has advanced in price from a few per cent to more than 100 per cent.

If this fact is taken into consideration the items that apparently have shown very large increases will not appear in so favorable a light while those that have shown decreases will appear in even a worse condition.

The exports of lamps for which quantities are known are increasing about as shown by the values. These, however, are but a small part of the total, being in March but 3 per cent.

	March		Nine Months Ended March	
Articles	1915	1916	1915	1916
Batteries	$166,041	$157,497	$685,206	$1,084,421
Dynamos or generators	236,305	72,022	1,610,442	1,037,735
Fans	20,533	18,376	119,439	252,842
Insulated wire and cables	236,849	269,606	1,002,230	2,188,763
Interior wiring supplies, etc., including fixtures	65,159	69,981	483,231	698,952
Arc lamps	2,409	3,191	27,404	15,359
Carbon filament lamps	8,133	9,548	55,233	125,441
Metal filament lamps	42,963	86,894	315,445	878,973
Meters and other measuring instruments	41,305	63,824	262,054	571,945
Motors	166,648	473,771	2,132,004	3,196,582
Telegraph instruments (including wireless apparatus)	7,335	19,703	57,404	115,820
Telephones	53,066	180,534	958,199	734,642
Transformers	27,562	87,520	482,960	694,469
All other	587,363	1,372,408	5,675,841	9,870,111
Total	$1,661,671	$2,884,875	$13,867,092	$21,466,055

Dwindling Labor Supply

With the daily demands of labor for higher wages and with the scarcity of labor very evident, the outlook in the general labor market is being viewed everywhere with apprehension. The situation, there is reason to believe, will become more acute within a very few weeks unless there is something done to release a large number of unskilled laborers to harvest the nation's crops.

The former vast army of unemployed has found work in industrial centers at almost undreamed-of wages. It is not thought that the farmers of the West will allow their crops to go unharvested because of high wages. Rather is it expected that labor will be given unusual inducements to desert the mill for the farm.

It is certain that there is not a sufficient supply of labor adequately to serve both agricultural harvesting demands and those of the country's factories. The difficulty undoubtedly is largely due to the cutting off of immigration in large numbers.

In connection with the dwindling supply of labor in this country the National Bank of the Republic of Chicago, in its June review of business, says: "The figures on immigration give some clue to the concern with which this subject has been viewed. In this rapidly growing country we have depended very largely on the incoming people of Europe for our supply of unskilled labor. This inward movement has been radically altered by the war. During the first twenty months following the outbreak of hostilities our net gain of arrivals over departures dwindled to the insignificant total of 173,000 persons. In the twenty months just preceding the war, and incidentally a period of business activity which offered no great inducement to immigration, our net gain was 1,511,000 persons. In view of the rapidity with which our growing industrial activity has absorbed our surplus of labor, this decline in immigration becomes a factor of first magnitude in checking any further enlargement of industrial output."

Reaction in Copper Prices

Electrolytic copper is nominally quoted for prompt and June delivery at 28.25 to 28.75 cents. A month ago the price was 30.50 cents, while the high price for 1916 was 31 cents. July and August deliveries of electrolytic are quoted at 28 to 28.50 cents and September and October deliveries at a quarter of a cent less.

This reaction in copper prices has also spread to a number of other metals, including tin, spelter, lead and antimony.

The prices, however, are for the most part nominal and sales are not being freely made. Second-hand dealers and dealers in small lots are making sales, but there is no apparent move on the part of the producers to sell at these lower prices. The producers who are sold up for many months are, of course, not taking any orders for fall or winter delivery except at prices a few cents above the nominal market quotations.

The decline is probably not more than an indication of the slackness of the metal market. What buying there is besides being very small is very irregular.

The large munition orders calling for unusual quantities of copper and brass that were reported a few weeks ago as about to be negotiated with large producers in this country have been definitely withdrawn.

Unusually Large Units Feature of Westinghouse Orders

Orders for unusually large machines have been a feature of the business of the Westinghouse Electric & Manufacturing Company during the past few months. In the fall several lighting companies ordered turbine-generator sets of around 45,000-hp. rating, which was at that time about the maximum size of these machines, as it was exceeded by but one or two units in existence. Shortly afterward a record was set when a 60,000-hp. unit was ordered; but this record did not stand long, as a 73,000-hp. set was contracted for a few weeks later. Finally, it is understood that this company is now designing a turbine-generator that will eclipse all of these and will probably remain the largest for some time.

The steel mills have been especially active in purchasing large apparatus. From one, the Inland Steel Company, what is said to be the largest order ever placed with an electrical manufacturer was obtained, and this included a 15,000-hp. motor, by far the largest ever built. Hardly had this order been entered than two other steel companies ordered motors of this same large size. Orders for motors of 8000 and 12,000 hp. have also been received during this period.

In several other lines of less general interest also the Westinghouse company is engaged in building the largest representative of its kind.

Manufacturing and Industrial

The Goldschmidt Thermit Company has removed its general offices to the Equitable Building, 120 Broadway, New York.

The Cooper Hewitt Electric Company, Hoboken, N. J., has moved its legal department from 165 Broadway to 120 Broadway, New York.

The Waterbury-Wallace Company, 19 East Twenty-fourth Street, New York, has taken over the business of the Wallace Novelty Company.

The Porcelain Products Company, Fulton Building, Pittsburgh, Pa., has been formed to manufacture dry press and high-tension insulating devices.

The Federal Miniature Lamp Division of the National Lamp Works of the General Electric Company has moved its office, formerly maintained at 16 East Fortieth Street, New York, to 6 East Thirty-ninth Street, New York.

The H. C. Roberts Electric Supply Company, Syracuse, N. Y., which has in the past been dealing wholesale only in electrical supplies, has moved to new quarters in East Genesee Street, Syracuse, where it is maintaining a retail automobile supply store and also a wholesale electric supply establishment.

The Standard Underground Cable Company, Pittsburgh, Pa., has recently opened a new branch office at 704 Wilkins Building, Washington, D. C. Edward Kerschner, formerly with the Philadelphia office of the company, is in charge of the new office.

The Borden Company, Warren, Ohio, manufacturer of pipe cutters, has appointed W. A. Phillis advertising manager. Mr. Phillis has lately been connected with the metallurgical and advertising departments of the National Tube Company of Pittsburgh, Pa.

The Roller-Smith Company, 233 Broadway, New York, has recently appointed the Electric Material Company, 589 Howard Street, San Francisco, Cal., as its agent. This concern will handle its products in parts of California, Oregon and Idaho and entirely in Nevada.

The Gee Electric Company, Wheeling, W. Va., jobber, dealer and repairer, has recently enlarged its quarters very materially. Besides having larger display rooms, the company is now thoroughly equipped, it is reported, to repair or rebuild various types of motors, armatures, etc.

New General Agents for "Delco Light."—Among the representatives which have been appointed recently by the Domestic Engineering Company of Dayton to handle the Delco Light are the Home Electric Light & Power Company of Boston, Mass., and the Domestic Electric Company of New York City.

The Packard Motor Car Company, Detroit, Mich., has appointed Alvan Macauley president of the company. Mr. Macauley was formerly vice-president and general manager, and he will succeed Henry B. Joy, who will still be connected with the Packard company as chairman of the board of directors.

The Triangle Conduit Company, 2010 Broadway, New York City, which has recently been formed, will be engaged in the manufacture and sale of armored conductors, flexible steel conduit and non-metallic conduit. The company is now building a new plant which will be ready for operation on Aug. 1. The officers of the company are James R. Strong, president; V. C. Gilpin, vice-president; J. E. McAuliffe, treasurer, and Francis W. Russell, secretary.

R. E. Parsons, for twenty years district manager at Kansas City for the National Cash Register Company, has opened a Kansas City office for selling the "Delco-Light" generating plant, and is gathering a force of twenty-five salesmen who will work from various county seats, selling the lighting plants to farmers. Each salesman will have one of the systems in a Buick or similar car, or on a trailer. Mr. Parsons' territory as general agent includes Missouri and Kansas.

The Dickey Steel Company.—Clyde E. Dickey has resigned his position as secretary and sales manager of Denman & Davis, with whom he has been associated for the past eleven years, and has organized the Dickey Steel Company, with offices in the Woolworth Building, New York. The new company of which Mr. Dickey is president will represent several manufacturers of high-grade steel. Mr. Dickey was with the Crucible Steel Company of America for nearly five years prior to his connection with Denman & Davis.

The United Electric Construction Company, 1727 Sansom Street, Philadelphia, Pa., which has recently opened an office at 101 Park Avenue, New York, with M. E. Ames in charge, has carried on an extensive electrical contracting business covering installations of complete electrical equipments for mills, factories, loft buildings, power houses, etc., and has had considerable success throughout eastern Pennsylvania, Philadelphia, New Jersey and Delaware. The Philadelphia establishment is maintained in a four-story building owned by the company. The concern is capitalized at $25,000. E. J. Ellis is president and W. McCandless, secretary.

New Location for Western Electric New York Retail Store.—Bigger, better business, coupled with the tendency of the electrical industry to center uptown, has resulted in a new location for the Western Electric Company's retail store in New York City. In its new quarters, in the Tilden Building, 105 West Fortieth Street, the store is situated but a stone's throw from Broadway, and is in the heart of a rapidly growing commercial section. Because of more commodious quarters, a larger assortment of electrical goods will be carried at the new location. A complete line of electrical supplies, both staples and specialties, is carried in stock.

The Electric Storage Battery Company, Nineteenth Street and Allegheny Avenue, Philadelphia, Pa., has recently started work on another big addition to its plant. The new addition will be devoted particularly to the manufacture of automobile starting and lighting batteries, and will consist of a six-story concrete building. Excavations have been made and the work of erection will be pushed as rapidly as possible. To provide for further expansion the company has purchased a large tract of ground opposite its present plant which extends from Eighteenth Street to Nineteenth Street and from Allegheny Avenue, a distance of 500 ft. to Westmoreland Street.

Standard Electric Time Company.—The Standard Electric Time Company of Springfield, Mass., has appointed W. G. Heacock as its representative at Cleveland, Ohio, with headquarters at 412 Rockefeller Building. Mr. Heacock will cover the territory comprising the eastern sections of Michigan, Indiana, Ohio, Kentucky, West Virginia and Pennsylvania, specializing in the design and installation of master clocks, program clocks and secondary clocks for schools. Mr. Heacock was formerly manager of construction and sales manager of the Electrical Maintenance Company of Youngstown, Ohio, coming there in 1914 from the Dauphin Electrical Company of Harrisburg, Pa.

The Universal Concrete Products Company, with general offices at 208 South La Salle Street, Chicago, has been organized with a capitalization of $2,500,000. J. R. Blackhall, general manager, Chicago & Joliet Electric Railway Company, Joliet, Ill., has been elected president of the company, and Frank B. Gifford, general purchasing agent, Armour & Company; William A. Levering, president, Standard Asphalt & Rubber Company; T. F. Massey, president, T. F. Massey & Company, and H. J. Mitchell, manager, Western United Gas & Electric Company, are the directors. The company is incorporated to manufacture concrete poles on a large scale for telegraph and telephone work and for ornamental street lighting systems. The poles are being manufactured in a small plant in Milwaukee at the present time, but plans for a large, new factory are under way.

The Electrical Talking Sign Company.—On page 1132 of the ELECTRICAL WORLD of May 13 it was announced that the Electrical Talking Sign Company had been formed by Messrs. C. A. Gardner, A. S. Reid and O. M. Rogers of 608 Dearborn Street, Chicago, Ill. It was also stated that the company proposed to manufacture electrical display advertising devices. According to a statement of H. B. Raymond, advertising manager of the company, C. A. Gardner is of New York and A. S. Reid of Newark, and the temporary address of the company is 311 East Forty-second Street, New York. Mr. O. M. Rogers is located at 608 Dearborn Street, Chicago, Ill., as previously noted. The company does not propose to manufacture electrical display advertising devices but to exploit in Greater New York a new invention which makes possible, Mr. Raymond points out, the instantaneous transmission of any message to the public by means of electric lamps. A news and advertising service will be offered to the New York public commencing about July 15.

The Norma Company of America to Erect a New Factory.—The Norma Company of America, 1790 Broadway, New York, manufacturer of ball bearings, announces through its president, W. M. Nones, the purchase of a 10-acre factory site at Elmhurst on the outskirts of Long Island City. The property fronts on Queens Boulevard and has a depth of about 1000 ft., abutting in the rear upon the main line of the Long Island Railroad, from which a siding will be built directly to the plant. The company has, during the last five years, become prominently identified with the automobile industry of the country. "Norma" bearings are now in demand for use with magnetos, lighting generators and starting motors. Although at first the Norma Company of America was only an importer of ball bearings, the steadily increasing demand forced the company into the manufacturing field and has necessitated repeated enlargements of its factory facilities. The latest move, it is reported, has been made in response to an im-

perative demand for a still larger immediate output. The plans now under way provide for a four-story building, 70 ft. by 350 ft., to be of reinforced-concrete construction. The architects for the new factory are Francisco & Jacobus of New York City.

Financial and Commercial Handbook on American Industries to Be Distributed in Russia.—An important step in the movement to introduce American goods into Russia has been taken by the American-Russian Chamber of Commerce in its decison to prepare for exclusive distribution in Russia a handbook on American financial and commercial conditions, containing a directory of selected American business houses. Hitherto American business firms have been unable to establish direct contact with Russian distributors and consumers, and Russian firms have had no means of developing direct connections with American business houses. The book, which will be printed entirely in Russian, will devote a section to a concise and summarized survey of industrial and commercial conditions in this country. There is a large demand, it is stated, for such information in Russia, and this booklet will present a condensed but complete summary of the principal features of the industrial and commercial development of this country and will furnish general information in regard to commercial organizations, commercial laws and the details of the organization of American public utilities, railroads, mineral resources, etc.

NEW YORK METAL MARKET PRICES

	May 29 Selling Prices Bid	May 29 Selling Prices Asked	June 6 Selling Prices Bid	June 6 Selling Prices Asked
Copper	£ s d	£ s d	£ s d	£ s d
London, standard spot	126 0 0		124 0 0	
Prime Lake	28.00 to 28.50†		28.00	to 28.50†
Electrolytic	28.25 to 28.75†		28.25	to 28.75†
Casting	26.25 to 26.75†		25.87½	to 26.12½†
Copper wire base	32.00 to 32.50†		32.00	to 32.50†
Lead	7.50		7.00	
Nickel	45.00 to 50.00		45.00	to 50.00
Sheet zinc, f.o.b. smelter	22.50†		21.00†	
Spelter	13.55 to 13.80		13.55	to 13.80
Tin, straits	47.00†		44.25	
Aluminum, 98 to 99 per cent.	57.00 to 59.00†		57.00	to 59.00†

OLD METAL

Heavy copper and wire	21.00 to 21.50†	21.00 to 21.50†
Brass, heavy	12.50 to 13.00†	12.00 to 12.50†
Brass, light	10.50 to 11.00†	10.00 to 10.50†
Lead, heavy	5.75 to 6.00†	5.25 to 5.50†
Zinc, new scrap	11.50 to 12.00†	9.00 to 9.50†

COPPER EXPORTS

Total tons to June 6 6,619

†Nominal.

Corporate and Financial

Citizens' Light & Power Company, Millersburg, Ohio.—The Public Utilities Commission of Ohio has granted permission to H. Wurdack, trustee, to issue $25,000 of promissory notes, bearing interest at 6 per cent and not to run more than two years. The notes are to be secured by a mortgage of the property of the Citizens' Light & Power Company which the commission has authorized him to purchase.

Cities Service Company, New York.—The company announces that at a meeting of its board of directors a policy covering dividend payments for the common stock was decided upon. In addition to the regular annual rate of 6 per cent in cash beginning Aug. 1, 1916, payable one-half of 1 per cent monthly as previously announced, the company will also pay 2 per cent on the common stock in common stock on Sept. 1, and an additional 4 per cent in common stock on Dec. 1. It is also the expectation of the board to pay 6 per cent in common stock in 1917, and thereafter to increase the dividends paid in common stock 3 per cent each year, so long as earnings of the company justify this policy. These stock dividends will be in addition to the regular rate of 6 per cent in cash per annum. The board also has voted to make an offer to the stockholders of the Toledo Traction, Light & Power Company to take over their holdings of the preferred and common stocks at approximately their present market prices. A similar offer will be made to the stockholders of the Lincoln Gas & Electric Light Company and to those of the Montgomery Light & Water Power Company. An offer will also be made to the holders of the preferred stock of the Electric Bond Deposit Company, by which they may exchange their stock, share for share, for Cities Service Company preferred stock. A special meeting of the stockholders of the Cities Service Company has been called for June 29, at which time they will be asked to approve an increase in the authorized capitalization of the company from $65,000,000 to $100 000,000, the increase to be from an authorized issue of $40,000,000 of preferred stock to $60,000,000 and from an authorized issue of $25,000,000 of common stock to $40,000,000. The former contract having expired, the company has entered into a new contract with Henry L. Doherty & Company by which it will pay only the actual expenses incurred in the management and operation of its properties, but, as further compensation the company has given to Henry L. Doherty & Company an option on $3,000,000 of common stock at $225 per share, and also the right to purchase one-third of all other common stock which may be issued in the next five years at $250 per share.

Corona (Cal.) Gas & Electric Company.—The California Railroad Commission has issued an order authorizing the company to execute a first mortgage on its properties as security for an issue of $58,500 6 per cent fifty-year bonds, and to issue these bonds. The bonds are to net not less than 90 and accrued interest. The proceeds from the sale are to reimburse the company for expenditures for additions and betterments, $33,339.05; to liquidate indebtedness owing to the Nevada-California Power Company, $18,849.66, and to the Southern Sierras Power Company, $422.18.

Greenfield (Mass.) Electric Light & Power Co.—At a recent meeting of the Greenfield Electric Light & Power Company it was voted to petition the Electric Light Commission for permission to issue $50,000 employees' stock. By law electric light companies may issue stock which is to be subscribed for by employees of the company thus issuing stock. The shares are $10 each, paying the same dividends as the regular stock. No employee may subscribe for more than $2,000 worth of stock. In the event of disposal it must be sold by an employee to another employee or to the company.

Milford (N. H.) Light & Power Company.—The New Hampshire Public Service Commission has issued an order authorizing the company to issue $37,500 of its 7 per cent preferred stock. Through a misapprehension of the effect of a previous order of the commission the company had inadvertently and without authority of the commission issued capital stock for a like amount. The proceeds from the sale of this invalid issue were used in building a transmission line, and the order of the commission just issued authorized the company to use the legal issue to take up the stock issued without authority from the commission.

Middle West Utilities Company, Chicago, Ill.—The company has organized the Southern Wisconsin Utilities Company, a subsidiary, which will take over electric light and power properties at Delavan, Lake Geneva, Genoa Junction and Walworth, Wis.

Montreal (Canada) Light, Heat & Power Company.—The gross and net revenue and surplus earnings for 1915 show substantial increases over the previous year, notwithstanding the unusual and disturbed business conditions that have prevailed throughout the period under review and the fact that there are at present upwards of 8000 vacant houses and stores in the city and suburbs, incident to the war and recruiting among householders. As a matter of fact, the increased earnings are in large measure due to electric power and gas sales for munition purposes and are, consequently, of a more or less temporary nature, it is stated by President H. S. Holt in his annual report for 1915. He goes on to say: "It remains an open question what trend business will assume after the conclusion of hostilities; it is natural to expect some general readjustment and we can only hope that the period will not be severe nor prolonged. The business profits war tax act, as recently enacted by the Dominion Government to provide for the payment of war debts, purports to tax for three fiscal periods subsequent to Dec. 31, 1914, the profits of all corporations in excess of 7 per cent on share capital and unimpaired reserves employed in the conduct of their business. It has been calcu-

lated that this company's contribution will amount in the aggregate to approximately $6,000,000. Two tax periods under the act have already accrued for your company; the first year's tax amounting to $169,344, has been provided out of suspense account, while that for this year has been provided out of current year's earnings. In addition to this extraordinary item of expense your company is experiencing inevitably higher costs as a result of abnormal prices and surtaxes prevalent on all raw materials and supplies used in its business—notably gas, oil and copper, of which naturally large supplies are annually required, and which are both selling at double the price of a year ago. There are innumerable other instances of abnormal prices for materials and supplies, such as coal, iron pipe and metals of all classes; in fact, some materials are totally unavailable and others can be secured in limited quantities only, and it will be incumbent upon your management to conserve such supplies as much as possible." The financial statement of the company's operations for the fiscal year ended April 30, 1916, follows:

Gross revenue		$6,877,167
Operation and maintenance	$2,856,798	
Depreciation and renewal reserve	675,000	
		3,531,798
Net revenue		$3,345,369
Fixed charges		487,181
Net income		$2,858,188
Dividends paid	$1,403,205	
Dividend payable May 15, 1916	467,735	
		1,870,940
Surplus from year's operations		$987,248
Less appropriations:		
Officers' and employees' pension fund	$10,000	
War tax	204,730	
		214,730
Transferred to general surplus		$772,518

Nevada-California Electric Corporation, Denver, Col.—To provide for its permanent financing, the Nevada-California Electric Corporation, organized a year ago to acquire the properties of the Nevada-California Power Company, the Southern Sierras Power Company, the Central California Electric Corporation and other smaller power and light companies, has issued $3,943,500 of 6 per cent first lien gold bonds, Series A.

New Orleans (La.) Railway & Light Company.—A block of $3,250,000 of refunding and general lien 5 per cent gold bonds due Nov. 1, 1949, has been sold at 92 and interest, netting 5.5 per cent.

Ohio Gas & Electric Company, Cincinnati, Ohio.—This company has filed a mortgage for $4,000,000 in favor of the Union Trust Company of New York at Hamilton, Ohio. The company recently purchased the property of the Middletown Gas & Electric Company, Middletown, and plants at Lisbon, Leetonia and Franklin, Ohio.

Public Service Company of Northern Illinois, Chicago, Ill.—The directors of the company, because of large increases being shown in earnings of the company applicable to dividends, plan an increase of the dividend rate on the common stock from 6 per cent to 7 per cent before the end of the current year.

San Diego (Cal.) Consolidated Gas & Electric Company.—The California Railroad Commission has authorized the company to buy on or before Sept 1, 1916, the entire issued capital stock of the Oceanside Electric & Gas Company, at $14 per share.

Seneca Power Corporation, Seneca Falls, N. Y.—A new issue of $450,000 of first mortgage 6 per cent gold bonds dated March 1, 1916, and due March 1, 1946, is being offered at par and interest.

Southern California Edison Company, Los Angeles, Cal.—The California Railroad Commission has authorized the Southern Counties Gas Company of California to purchase the gas properties of the Southern California Edison Company, and of the Long Beach Consolidated Gas Company. The Southern Counties company pays $1,050,000 for the Edison Company's properties and $950,000 for the Long Beach property.

Tennessee Railway, Light & Power Company, Chattanooga, Tenn.—The industrial depression of 1914 continued in an aggravated form throughout most of 1915 and the resulting economy among all classes of people affected adversely the earnings of public utility companies, it is stated by C. M. Clark, president of the company, in his annual report. In addition the street railway business in Nashville was affected by jitney competition and in Chattanooga by a smallpox epidemic. The improvement shown in the gross and net earnings, it is stated, was due to additional power business and to normal rainfall and stream flow which enabled the hydroelectric plants to supply a very large percentage of the power requirements, whereas in 1914 the drought necessitated an abnormal amount of costly steam generation. Interest charges increased with the completion of the larger construction work and the resulting charge was against operation instead of capital. Of the total gross earnings, 33.9 per cent was derived from retail power and light, 14.6 per cent from wholesale power and the remaining 51.5 per cent from street railway earnings. The combined results of the company and its subsidiaries—the Nashville Railway & Light Company, the Chattanooga Railway & Light Company and the Tennessee Power Company—for 1915 and comparison with 1914, all transactions between these companies being eliminated, are shown in the following statement:

	1915		1914
Gross earnings	$3,947,268		$3,762,387
Operating expenses, rentals and taxes	2,267,394		2,270,989
Net earnings	$1,679,874		$1,491,398
Interest	$1,320,263	$1,194,420	
Dividends paid on stocks of constituent companies not owned by Tennessee Railway, Light & Power Company	108,472	109,049	
	1,428,735		1,303,469
Balance	$251,139		$187,929

Twin State Gas & Electric Company, Dover, N. H.—A block of first and refunding mortgage 5 per cent gold bonds is being offered at 92 and interest, yielding 5.5 per cent.

New Utility and Industrial Companies

The Kingsport Power Company of Kingsport, Tenn., has been incorporated by Edwin G. Woodling and others for the purpose of furnishing electrical service in Kingsport.

The Sandy Creek Township Power Company of Franklin, Pa., has been granted a charter with a capital stock of $5,000. Joseph McCormack of Erie, Pa., is treasurer.

The Lakewood Electric Company of Lakewood, Ohio, has been incorporated to do a general electrical contracting business. The officers are: G. C. Davis, president and treasurer, and E. A. Scherer, vice-president and secretary.

The W. Bielanski Company of Buffalo, N. Y., has been incorporated by W. Bielanski, K. Kaminski and W. Fabianski, 921 Broadway, Buffalo, N. Y. The company is capitalized at $30,000 and proposes to deal in hardware, supplies, gas and electric fixtures, etc.

Charles B. Foley, Inc., has filed articles of incorporation with a capital stock of $75,000 for the purpose of developing inventions relating to electric induction furnaces, crucibles, etc. The incorporators are: A. Stetson, J. L. Schermerhorn and W. F. Hubley, 145 Miller Street, Newark, N. J.

The Majestic Machine & Tool Company of New York, N. Y., has been incorporated by G. F. Meyers, M. Janiger and S. Halper, 117 West 114th Street, New York, N. Y. The company is capitalized at $5,000 and proposes to manufacture and deal in motors, dynamos, factory supplies, appliances, etc.

The Martin Electrical Manufacturing Company of New York, N. Y., has been granted a charter with a capital stock of $50,000 to manufacture photograph films, supplies, contracting, electrical work, motion pictures, etc. The incorporators are: H. C. Price, J. J. Murphy and R. Martin, 1063 Simpson Street, Bronx, New York, N. Y.

The Aerated Stove Company of United States of America has filed articles of incorporation with a capital stock of $500,000. The company proposes to manufacture and deal in stoves, furnaces, radiators, ranges, gas and electrical appliances. The incorporators are: S. Sabel, J. Davidson and M. B. Hoffman, 161 West Thirty-sixth Street, New York, N. Y.

The French Creek Township Power Company of Franklin, Pa., has been incorporated with a capital stock of $5,000. Joseph McCormack of Erie, Pa., is treasurer.

The Palmyra Electric Company of Palmyra, Wis., has been incorporated with a capital stock of $10,000 by L. V. Cram, Delia E. and Walter W. Cram to supply electricity in Palmyra.

The Arkansas Hydro-Electric Development Company of Little Rock, Ark., has been incorporated with a capital stock of $50,000 by Dr. A. R. Amos, W. D. Dickinson, E. T. Stanfield and G. A. Watkins.

The West Wildwood Water & Power Plant of West Wildwood, N. J., has filed articles of incorporation with a capital stock of $100,000 to construct and operate an electric light plant and water-works system in part of Middle Township in Cape May County. The incorporators are: George Flint, Warren D. Hann, John W. Hann, Walter W. Harte and Henry W. Harte.

The Electrical Transmission Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000. The company proposes to purchase and operate plants for generating and distribution of electricity, gas, etc. The incorporators are: M. M. Hirons, John P. Le Fevre, L. B. Phillips and Walter P. Carrow of Dover, Del.

The Deschutes Hydro-Electric Process Company of Portland, Ore., has been incorporated by John A. Jeffrey, C. D. Charles and E. Z. Ferguson of Portland, Ore. The company is capitalized at $350,000 for the purpose of promoting industrial water power development to generate electrical energy for the production of atmospheric nitrogen and its fixation with lime and other minerals, and for the production and manufacture of acids.

Trade Publications

Canopy Switches.—The Bryant Electric Company, Bridgeport, Conn., is sending out a leaflet descriptive of several types of small canopy switches.

Steam Pumps.—The Emerson Pump & Valve Company, Alexandria, Va., has prepared a number of illustrated bulletins descriptive of its steam pumps.

Portable Electric Range.—Landers, Frary & Clark, New Britain, Conn., have prepared an illustrated folder descriptive of electrically operated portable ranges.

Electric Pumps.—The George J. Roberts Company, Dayton, Ohio, has issued several illustrated bulletins descriptive of its electrically operated pumping outfits.

Conduit-Fittings and Wiring Devices.—Bulletin C-F, issued by M. B. Austin & Company, Chicago, Ill., describes and illustrates various types of conduit fittings, tools and wiring devices.

Dolly-Type Washer.—The Clarinda Lawn Mower Company, Clarinda, Iowa, is sending out illustrated booklets containing information on its motor-driven direct-drive washing machines.

Small Motors for Washing Machine Service.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a folder entitled "Small Motors for Washing Machine Service."

General Utility Driving Device.—An illustrated folder descriptive of a general utility motor-driven device for driving kitchen appliances has recently been issued by the Reynolds Electric Company, Chicago, Ill.

Small Separable Attachment Plugs.—Bulletin No. 15-19, prepared by Harvey Hubbell, Inc., Bridgeport, Conn., contains information on small separable attachment plugs and elongated composition plug caps.

Batteries in Stand-By Service.—Bulletin No. 158, issued by the Electric Storage Battery Company, Philadelphia, Pa., is descriptive of the "Exide" battery in stand-by service for the Detroit Edison Company.

Coal-Conveying Equipment.—Catalog No. 20, issued by the R. H. Beaumont Company, Philadelphia, Pa., describes and illustrates various types of coal-handling and ash-handling equipment for boiler houses.

Electric Dish Washer.—The Metropolitan Engineering Company, 35 Vestry Street, New York, has prepared an attractively illustrated brochure descriptive of its family and restaurant-size electrically operated dish-washing machines.

Electric Bulletin.—The National Electric Bulletin Corporation, New London, Conn., has issued an attractively illustrated catalog which contains information on its Style A and Style B electric-bulletin machines designed especially for use by newspapers.

Direct-Current Motors and Generators.—Bulletin No. 106 published by the Diehl Manufacturing Company, Elizabeth, N. J., describes and illustrates the company's Type G direct-current motors and generators, and shows various applications of these machines.

Copper Fittings.—The Electrical Engineers Equipment Company, 711 Meridian Street, Chicago, has issued Bulletin 105 containing descriptions, illustrations, catalog numbers and other data on copper fittings, connectors, copper tubing, copper wire and copper cable.

Solderless Connectors.—The Frankel Connector Company, 177 Hudson Street, New York, has issued an illustrated catalog which contains information on solderless connectors for stranded or solid wires (recently described in these columns), electric testing clips and spark plugs.

Small Self-Contained Lighting Outfit.—Catalog D, issued by the Matthews Company, Port Clinton, Ohio, describes and illustrates several types of small self-contained generating outfits. Bulletin No. 2 and Circular G prepared by the company also describe and illustrate these plants.

Erection of Storage-Battery Plants.—"What We Are Doing to Meet Our Increasing Business" is the title of Bulletin No. 157 issued by the Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia, Pa., which contains various illustrations of the company's manufacturing plants.

Brushes.—Catalog No. 20, recently issued by the American Carbon & Battery Company, East St. Louis, Ill., is entitled "Carbon, Graphite and Metal Graphite Motor and Generator Brushes." The various grades of brushes are fully described and use is made of graphic charts and tables to make the descriptions as clear as possible.

Electric Fans.—The Crocker-Wheeler Company, Ampere, N. J., has prepared an attractive leaflet which contains information on its 9-in. electrically operated fans. The leaflet also contains some interesting information on the development of the electric fan in which Dr. S. S. Wheeler, the president of the company, figured quite prominently.

Engine Indicators and Accessories.—The Trill Indicator Company, Corry, Pa., has issued a new fifty-six-page catalog on engine indicators and accessories. It also contains information on taking and reading of indicator cards. The catalog is profusely illustrated and describes in detail the construction of both the outside and inclosed spring types of indicators.

Humidifying Apparatus.—Bulletin No. 100, issued by the Carrier Engineering Corporation, 39 Cortlandt Street, New York, is attractively illustrated and contains considerable information on humidifying apparatus. The bulletin contains details on air supply, fixing the amount of water vapor, heating, cooling, securing various humidities from one apparatus, etc.

Cooling Ponds, Air Washers and Coolers.—The Spray Engineering Company, 93 Federal Street, Boston, Mass., has just issued a booklet which gives a list of the cooling-pond air-washer installations made by the company. Installations of cooling ponds have been made in thirty-five States, Canada, Mexico, Cuba and South Africa. Air-washer installations have also been made in twenty-one States.

Selling Electric Ranges.—"Something In It For You" is the title of an attractive booklet just issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which contains information which should be of considerable help to agents and dealers in marketing Westinghouse ranges. The company has also just published descriptive Leaflet No. 3803 on two-speed induction motors and a bulletin designated as Reprint No. 36 entitled "Electric Power for Cotton Gins" reprinted from the *Electric Journal* of August, 1914.

New England

WESTBROOK, ME.—The Public Utilities Commission has approved the purchase of the property of the Westbrook (Me.) Electric Company by the Cumberland County Power & Light Company of Portland.

FRANKLIN, N. H.—The Franklin Light & Power Company is contemplating removing its wires from Central Street.

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 24 for repairing two Buckeye engines in the central power plant at the navy yard, Portsmouth.

ARLINGTON, VT.—The Public Service Commission has granted the Arlington Light & Power Company, recently incorporated, permission to do business in Arlington. The company is capitalized at $50,000 and proposes to supply electricity in Arlington, Sunderland and Sandgate. Otto C. F. Kinum of Schenectady, N. Y.; Albert E. Buck, Victor L. Smith of East Arlington, and Martin P. Deming of Arlington are among the incorporators.

ENOSBURG FALLS, VT.—At an election held May 23 the proposal to build a new municipal electric-light plant, at a cost of $10,000, was defeated.

ST. ALBANS, VT.—The Public Electric Light Company of St. Albans has applied to the Public Service Commission for permission to extend its electric transmission lines to Cambridge, Jeffersonville and Milton to furnish electrical service in those towns. F. C. Wilkinson of St. Albans is manager of the company.

HOLYOKE, MASS.—Bonds to the amount of $30,000 have been authorized for extensions and improvements to fire-alarm system.

LUDLOW, MASS.—The Board of Selectmen has granted the Ludlow Electric Light Company permission to extend its transmission lines from North Street to East Street. Application has been made to the Selectmen for permission to erect a transmission line on Center Street from Hampden Railroad to Ludlow Center, a distance of about 3 miles.

LYNN, MASS.—A permit has been granted the Campbell Electric Company for the erection of a six-story addition, 55 ft. by 112 ft., to its factory on Stewart Street.

NORTHFIELD, MASS.—At a special town meeting held recently the voters rejected the proposal of the Greenfield (Mass.) Electric Light & Power Company to take over the local system. It was voted to make arrangements with the company to light the streets of the town.

WARE, MASS.—The Connecticut River Transmission Company of Worcester is planning to erect a 22,000-volt transmission line from the substation in Ware to Palmer.

BRIDGEPORT, CONN.—The officials of the Electric Cable Company have announced that extensions will be made to its plant in Bridgeport during the coming year, involving an expenditure of $100,000, and that more will be expended on the plant of the Habershaw Electric Cable Company of Yonkers, N. Y. The two companies were recently merged.

BRIDGEPORT, CONN.—Bids will be received by the Board of Contract and Supply, Bridgeport, Conn., until June 17 for construction of municipal ice and storage building, including insulation and elevator; also for equipment for municipal ice-making and cold storage plant. Plans and specifications may be obtained on application to Fletcher-Thompson, engineers, Bridgeport, upon deposit of $25 for each set of plans.

Middle Atlantic

BROOKLYN, N. Y.—Plans have been prepared by Helmle & Corbett of Brooklyn, architects, for a power plant to be built on Grand Avenue near Flushing Avenue.

BROOKLYN, N. Y.—Herbert H. Giles, 594 Kosciusko Street, Brooklyn, is planning to equip a factory for manufacturing buttons, baby novelties, etc., out of bone and vegetable ivory, and will need electric motors, etc., to operate machinery.

BROOKLYN, N. Y.—The Public Service Commission has granted the Kings County Electric Light & Power Company of Brooklyn permission to issue $472,000 in bonds, the proceeds of $311,454 to be used for extensions and improvements and completion of plans, and the remainder for reimbursement of funds expended.

ELIZABETHTOWN, N. Y.—The local electric-light plant, owned by C. M. Wood, and Lobdell Brothers' water power on the branch of Little Boquet in Elizabethtown, have been purchased by Paul Webster. The new owner proposes to enlarge the plant and improve the service.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

LYSANDER, N. Y.—The Public Service Commission has approved the exercise of franchises granted the Seneca River Power Company of Baldwinsville to erect and operate electric transmission and distribution lines in Lysander.

NEW YORK, N. Y.—Designs are being prepared by a committee of engineers for a combination post to carry both fire-alarm boxes and electric lamps to be submitted to the Board of Estimate and Apportionment. Robert Adamson, fire commissioner, recommends the immediate purchase of poles for fire-alarm boxes exclusively.

NEW YORK, N. Y.—Bids will be received at the office of the Depot Quartermaster, Army Building, New York, N. Y., until June 30 for furnishing and delivering as called for during the year beginning July 1, 1916, from 1 to 1000 1½-ton, and from 1 to 1000 3-ton motor trucks. Alternate bids are invited for bodies only and for chasses only.

NEW YORK, N. Y.—The Automatic Scoreboard Company of New York has applied for a franchise to construct, maintain and operate electrical conductors in and through the streets and highways of New York City for the purpose of operating automatic baseball scoreboards, and also for a temporary permit therefor pending the grant of such a franchise. Charles Harris is vice-president of the company.

TOMPKINSVILLE, N. Y.—Bids will be received by the light house inspector, Tompkinsville, until June 14, for furnishing at the light house depot, Tompkinsville, two oil engine air compressor units and one 200-hp. internal combustion propelling engine.

TROY, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 5 for installing complete a new electric elevator, including certain alterations in the United States post office, court house, etc., at Troy, N. Y. For details see proposal columns.

ASHVILLE, PA.—Preparations are being made by the Penn Central Light & Power Company of Altoona to extend its service to Ashville.

ERIE, PA.—Bids will be received by the board of directors of the school district of the city of Erie until June 27 for the construction of the Erie Academy High School Building as follows: (1) General work; (2) plumbing, sewering and gas fitting; (3) heating and ventilating apparatus; (4) electric work; (5) clocks, bells and telephones. Plans and specifications may be obtained on application to William B. Ittner, architect, St. Louis, Mo. W. J. Flynn is business manager.

HIGHSPIRE, PA.—The Borough Council has approved an ordinance providing for lighting the streets of the borough with electricity. The plans provide for the erection of a number of 100-cp. and many 60-cp. lamps.

LANSFORD, PA.—The ordinance granting the Panther Valley Electric Company permission to erect a high-tension line to its new power station in Lansford has been vetoed by Chief Burgess Gallagher. The burgess thinks that the wires should be placed underground.

MARCUS HOOK, PA.—The American Viscose Company is reported to have awarded the contract for the construction of a new electric power plant to William Provost of Chester.

UNIONTOWN, PA.—Plans are being prepared for the installation of a new street-lighting system in Uniontown. It is proposed to replace the arc-lamp lighting system with nitrogen lamps. The West Penn Electric Company has the contract for street-lighting.

BAYONNE, N. J.—Plans have been submitted to the City Commissioners by the city engineer for a municipally owned conduit system, to cost about $400,000; also an estimate for a system to cost $250,000.

NEWARK, N. J.—The Public Service Electric Company is planning to build a coal handling plant at its new power station at Point-No-Point, to cost about $150,000.

PLAINFIELD, N. J.—The American Motor Corporation of New York is planning to build a power house in connection with its new manufacturing plant in Plainfield.

SEA ISLE CITY, N. J.—The Public Utilities Commissioners have approved a mortgage executed by the Sea Isle City Electric Light, Power & Water Company for $10,000, the proceeds to be used for improvements to plant.

TRENTON, N. J.—Bids will be received until June 15 for a new boiler house and plumbing plant for the New Jersey State Hospital. George S. Drew of Trenton is architect.

WILDWOOD, N. J.—The West Wildwood Water & Power Company of Wildwood, recently incorporated with a capital stock of $100,000, proposes to operate an electric-light plant and water-works system.

BALTIMORE, MD.—All bids opened May 23 for lighting Hanover Street Bridge have been rejected by the State Roads Commission.

BALTIMORE, MD.—The Southern Stevedoring Company has awarded the contract for construction of powerhouse at Canton to the Consolidated Engineering Company, Calvert Building, Baltimore, Md. The Mead-Morrison Manufacturing Company, Equitable Building, Baltimore, will have charge of the engineering work.

THURMONT, MD.—The Borough Council has decided to light the streets of the borough with electricity. Nothing definite has yet been decided upon. At present the borough is without street-lighting service.

CHARLESTON, W. VA.—The installation of an ornamental street-lighting system in the business district is under consideration.

EASTBANK, W. VA.—At an election held recently the proposal to establish a municipal electric-light plant in Eastbank was carried.

RICHMOND, VA.—The Virginia Railway & Power Company of Richmond has submitted a proposal to furnish electricity to the city cheaper than it can be generated at the municipal plant. The city is contemplating the installation of new equipment in the municipal electric-light plant, to cost about $35,000. E. W. Trafford is superintendent of the municipal electric plant.

WASHINGTON, D. C.—Bids will be received by the Commissioners of the District of Columbia, Room 509, District Building, Washington, D. C., until June 15 for furnishing six bronze lamp posts. Specifications, etc., may be obtained from the purchasing agent, Room 320, District Building.

North Central

CALUMET, MICH.—Plans for the installation of an ornamental lighting system in Calumet have been submitted to the City Council by the Houghton (Mich.) County Light Company.

DEERFIELD, MICH.—The Tecumseh (Mich.) Electric Company is negotiating with the Village Council relative to extending its transmission lines to Deerfield. If the deal is carried through the company will supply electrical service to residences and farms along the line.

GRAND RAPIDS, MICH.—The contract for electrical work for the Maris Building, Fulton Street, has been awarded to the W. M. Ackerman Electric Company of Grand Rapids.

LAKE LINDEN, MICH.—Bids will be received at the office of Dr. George W. Orr, secretary of board of education until June 26 for construction of a new high school and boiler house at Lake Linden. Separate bids to be submitted as follows: General construction, heating and ventilation, heat regulation, plumbing, electric work, telephone system, and clock and signal system. Plans and specifications may be obtained on application to John D. Chubb, architect, 109 North Dearborn Street, Chicago, Ill.

LAPEER, MICH.—The Lapeer Gas-Electric Company, it is reported, has placed orders for additional electric generating unit, consisting of a large engine and General Electric generator.

PLYMOUTH, MICH.—Bids will be received at the office of Dr. J. J. Davis, president of the board of education, Plymouth, Mich., until June 24 for the construction of a new public school building. Separate bids to be submitted for plumbing, heating, ventilating and electric wiring. Plans and specifications are on file at the office of R. A. LeRoy, architect, 122 Pratt Building, Kalamazoo. Copies of plans and specifications may be obtained at the office of the architect upon deposit of $20; specifications without plans may be taken upon deposit of $5.

ATHENS, OHIO.—The contract for the installation of the ornamental street-light-

ing system in the business section has been awarded to De Molet & Cromwell of Athens. Iron standards mounted with a single 200-cp. nitrogen incandescent lamp will be used. All telephone poles will be removed, eliminating poles entirely in the business district.

CINCINNATI, OHIO.—Bids will be received by C. W. Handman, business manager of the board of education, 511 West Court Street, Cincinnati, until June 26 for installation of a vacuum cleaning system in the Raschig public school building. Plans and specifications are on file in the above building.

CINCINNATI, OHIO.—Bids will be received by the city clerk, Denton Building, Cincinnati, until June 26 for the electric-light installation in the main building of the Twenty-third District public school. Plans and specifications are on file in the office of C. W. Handman, business manager, board of education, 511 West Court Street.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until June 14 for freight elevator for the Division Avenue pumping station. Specifications may be obtained at the office of the deputy water commissioner, 413 Superior Avenue, City Hall.

COLLEGE CORNER, OHIO.—A franchise has been granted to J. H. McCray to construct and operate an electric-light plant in College Corner.

DOVER, OHIO—Improvements are contemplated to the water-works system, including the installation of an electrically driven pump of 2,000,000-gal. capacity, 1,500,000-gal. standpipe, extensions to water lines, etc., to cost about $80,000. George Arnold of New Philadelphia, Ohio, is engineer.

SOUTH CHARLESTON, OHIO—At an election to be held June 13 the proposal to issue $12,000 in bonds for the installation of an electric-light plant will be submitted to the voters.

PADUCAH, KY.—The Retail Merchants' Association has petitioned the City Council to appropriate $30,000 for the installation of an ornamental lighting system on Broadway. If the plan is accepted extensions will be made to the municipal electric-light plant.

WHITESBURG, KY.—The Commercial Club is considering the question of establishing an electric-light plant in Whitesburg.

MOUNT VERNON, IND.—The City Council has authorized the light committee to purchase 40 "Luxalabra" lamps for Main Street.

NATIONAL MILITARY HOME, IND.—Bids will be received at the office of superintendent of post fund, Marion Branch, National Home Disabled Volunteer Soldiers, National Military Home, Grant County, Ind., until June 13 for furnishing and installing two electric passenger elevators and one 100-kw., 1100-volt, two-phase, 60-cycle turbogenerator unit, in accordance with instructions and specifications, copies of which with blank proposals can be obtained upon application to E. B. White, superintendent of post fund.

CALEDONIA, ILL.—Investigations are being made by the Illinois Northern Utilities Company of Dixon with a view of extending its service to Caledonia.

CHICAGO, ILL.—At an election held June 5 bonds to the amount of $3,750,000 were voted for extensions to the street-lighting system.

HARRISBURG, ILL.—The Southern Illinois Railway & Power Company is planning to extend its line to Marion, Herrin and Benton, and also to construct a loop from Benton to Herrin via Duquoin.

MACOMB, ILL.—Bids will be received in the office of James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago, until June 19 for construction of art building on the campus of the Western Illinois Normal School, Macomb. Separate bids will be received at the same time for plumbing, heating and electric wiring. Copies of plans may be obtained at the office of the state architect, upon deposit of $10.

PEORIA, ILL.—Bids will be received at the office of the city clerk of the city of Peoria by the lights and lamps committee of the City Council until June 13 from engineers for an examination of the rates now charged by the Central Illinois Light Company, for electrical and gas service, with a view of establishing lower rates for such service. For details see proposal columns. William E. Moran is city clerk.

WARREN, ILL.—The State Public Utilities Commission has granted the Warren Light & Power Company permission to issue $10,500 in notes.

WAUKEGAN, ILL.—The Pfanstiehl Company of Waukegan, it is reported, is planning to build a new work shop in which tungsten electrical appliances will be made. Estimates are now being prepared on the erection of a new building.

LA CROSSE, WIS.—The local electric plant of the Wisconsin-Minnesota Light & Power Company was recently destroyed by fire, causing a loss of about $75,000.

MARKESAN, WIS.—A subscription has been raised by business men and property owners for the installation of an ornamental lighting system on Bridge and John Streets.

PALMYRA, WIS.—The Palmyra Electric Company, recently incorporated with a capital stock of $10,000, proposes to supply electricity in Palmyra. D. W. Cram and other are interested in the company.

TWO RIVERS, WIS.—The city of Two Rivers is reported to have granted the Wisconsin Public Service Company of Green Bay a franchise to extend its transmission lines to Two Rivers.

WASHBURN, WIS.—The City Council and the Commercial Club are considering the installation of an ornamental lighting system, covering seven blocks, on Main Street.

ALEXANDRIA, MINN.—The Council has engaged John F. Druar, Commercial Building, St. Paul, to make investigations and estimates of cost of improvements required at the municipal electric plant.

BARNESVILLE, MINN.—The Otter Tail Power Company of Fergus Falls has submitted a proposal to the City Council to take over the municipal electric-lighting system. If the deal goes through the company will erect a high-tension transmission line from Fergus Falls to Barnesville.

BARRETT, MINN.—Bids will be received by the village of Barrett until June 21 for erection of transmission line. Earle D. Jackson, Capitol Bank Building, St. Paul, is engineer.

BEMIDJI, MINN.—An election will soon be held to submit to the voters the proposal to establish an ornamental street-lighting system in Bemidji.

DETROIT, MINN.—Bids will be received by the city of Detroit for one 250-hp. water tube boiler with stoker equipment complete, one concrete chimney, remodeling switchboard and installation of voltage regulator, and feed water heater; also construction of addition to powerhouse. The Charles L. Pillsbury Company of Minneapolis is consulting engineer.

EYOTA, MINN.—The municipal electric-light plant at Eyota has been purchased by the Northern Electric Power Company. W. H. Adams and J. A. Baker, promoters of the company, propose to erect a transmission line from Winona to villages served.

HARTLAND, MINN.—The installation of an ornamental street-lighting system in Hartland is under consideration. J. A. Halverson and others are interested.

KEEWATIN, MINN.—Bids will be received by the village of Keewatin until July 12 for the following material: 2400 ft. 1¼-in. iron conduit pipe, 10 cast-iron standards, 14 ft., 34 1¼-in., 90 deg. conduit pipe bends, 12 1¼-in. couplings, 2400 ft. No. 6 lead-covered cable, tested at 5000 volts and uniform B. S. gage, 10 Lundin cut-outs, absolute series. C. W. Extrum, village clerk.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company is contemplating the erection of a one-story substation at 930 Hennepin Avenue, at a cost of about $7,000.

OSLO, MINN.—The Oslo Electric Light & Power Company, it is understood, is contemplating the installation of a storage battery next fall.

SAUK CENTER, MINN.—An option on the property of the Central Minnesota Power & Milling Company of Sauk Center, it is reported, has been taken by the Minnesota Light & Power Company of St. Cloud. A. G. Whitney, president of the St. Cloud Public Service Company, is interested in the Minnesota company.

STILLWATER, MINN.—The City Council has accepted the proposal of the Northern States Power Company, which controls the Consumers Power Company, for street lighting for a period of ten years, and for furnishing electricity and gas for municipal purposes, including the operation of the electrically driven pumps for water-works system.

WABASHA, MINN.—Surveys have been made by the Wisconsin-Minnesota Light & Power Company of Eau Claire, Wis., for the erection of an electric transmission line to Wabasha; work will begin at once on the line. Towers between Lake City and Wabasha will be rebuilt.

AURORA, IOWA.—The Smith Power & Light Company of Arlington has been granted a franchise to install and operate an electric-lighting system in Aurora.

LEWIS, IOWA.—Bids will be received at the office of G. E. Weaver, secretary of board of education, Lewis, until June 27 for construction of school building for the Consolidated Independent School District of Lewis County. Separate bids to be submitted on general contract, heating and plumbing, and electric wiring. Plans may be seen at the office of Proudfoot, Bird & Rawson, architects, Hubbell Building, Des Moines, and at the office of the secretary of board of education at Lewis.

LYONS, IOWA.—The Commercial Club is considering the installation of an ornamental lighting system in the business section.

MAPLETON, IOWA.—The Electrical Development Company of Omaha, Neb., is reported to have purchased the electric-light franchise held by Albert Luzen. Preparations are being made by the company to supply electrical service in Mapleton.

RANDOLPH, IOWA.—The Town Council has awarded the contract for the erection of the electric transmission line, from the main line 4 miles west of the town, to the McGraw Electric Company of Omaha, at $4,920.

BRECKENRIDGE, MO.—The Hamilton (Mo.) Electric Light Company is planning to extend its transmission line to Breckenridge to supply electrical service here.

ELVINS, MO.—The City Council has granted the Missouri Public Utilities Company of Cape Girardeau a franchise to install and operate an electric-lighting system in Elvins.

KANSAS CITY, MO.—Ordinances have been passed by the City Council providing for replacing 24 lamps of 100 cp., 21 arc lamps and 20 gas lamps with 60 tungsten lamps of 250 cp. in the First Ward.

MOUNT VERNON, MO.—Plans have been completed for improvements to the municipal electric-light plant and water-works system, to cost about $15,000. Funds will not be available before September, 1916. Albert C. Moore, Frisco Building, Joplin, is engineer.

RIVERMINES, MO.—The Doe Run Lead Company is reported to have engaged Veile, Blackwell & Buck, 49 Wall Street, New York, N. Y., to take charge of the engineering work in connection with the construction of its proposed power plant.

TRENTON, MO.—Bids will be received by the village of Trenton until June 16 for furnishing material and installing an electric-lighting system, separate bids to be submitted as follows: For furnishing material and labor for installing system complete; for furnishing and installing one 35-hp. to 40-hp. oil engine directly connected to one 25-kw. direct-current generator, storage battery, switchboard; for furnishing equipment and erecting pole line and street-lighting system, and construction of brick power station. Fairbanks, Morse & Company of Omaha, Neb., are engineers. A. L. Taylor is village clerk.

WEBB CITY, MO.—Bids will be received by A. H. Waite, chairman of the Jasper County Board of Tuberculosis Hospital Commissioners, Keystone Building, Joplin, until July 1 for construction of the Jasper County Tuberculosis Hospital, to be erected about 1½ miles south of Webb City. Separate bids to be submitted on general contract, heating apparatus, kitchen equipment, laundry machinery, and refrigerators. Plans and specifications may be seen at the above office and at the office of Rose & Peterson, architects, Kansas City, Kan.

CLEVELAND, N. D.—Plans are being considered for the installation of an electric-light plant, to cost about $10,000. M. Simonitsch is interested.

FESSENDEN, N. D.—Bids will be received by the secretary of the Fessenden auditorium, Fessenden, until June 19 for construction, including electric wiring and heating plants, of a two-story auditorium and business block.

GACKLE, N. D.—The installation of an electric-light plant in Gackle is under consideration. W. K. Bauhous is reported interested.

PACTOLA, S. D.—Plans are being considered by the Dakota Power Company of Rapid City for the construction of a power dam on Rapid Creek at Pactola, to cost about $1,000,000. The flood waters of creek will be used to develop about 5000 hp. to generate electricity and to irrigate 40,000 acres of land.

SPRINGFIELD, S. D.—Bids will be received at the office of Indian Affairs, Department of the Interior, Washington, D. C., until June 17 for construction of frame cottage and electric lighting in accordance with plans and specifications, which may be examined at the United States Indian warehouses at Chicago, Ill., and St. Louis, Mo.; the Builders' Exchange,

St. Paul, Minn., and at the office of the superintendent of the Springfield School, Springfield.

GENEVA, NEB.—The property of the Geneva Electric Company has been purchased by the Continental Gas & Electric Corporation of Cleveland, Ohio.

HOLBROOK, NEB.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-light plant.

HERINGTON, KAN.—The installation of an ornamental lighting system on Main Street and Broadway in the business district is under consideration.

LEWIS, KAN.—Bonds to the amount of $15,000 have been voted for the installation of an electric distribution system and the erection of a transmission line to connect with the electric plant owned by A. L. Moe of Kinsley. I. C. Bushong of Ottawa is engineer.

NORCATUR, KAN.—Bonds to the amount of $22,500 have been voted for the installation of a municipal electric-light plant.

OSKALOOSA, KAN.—The contract for the erection of the new transmission lines (2½ miles) in connection with the waterworks system has been awarded to Moxley & Company, owner of the local electric-light plant.

STERLING, KAN.—At an election to be held June 27 the proposal to issue $45,000 in bonds for the purchase of the property of the Morris Electrical Power Company will be submitted to the voters.

Southern States

CULLOWHEE, N. C.—The construction of a hydroelectric plant is reported to be under consideration by the Cullowhee Milling Company.

FREMONT, N. C.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-lighting system was defeated.

GAFFNEY, S. C.—Right of way for the purpose of extending its transmission lines into Gaffney has been obtained by the Southern Power Company of Charlotte. A site for the substation has been secured and the right of way from Gaffney to Rutherford, N. C., via Forest City, Caroleen, where the company proposes to supply electricity to operate the mills.

GREAT FALLS, S. C.—The contract for electrical equipment for the new Republic Cotton Mills at Great Falls has been awarded to Huntington & Guerry of Greenville.

SPARTANBURG, S. C.—The Interborough Power Company is planning to construct a hydroelectric plant on Tyger River, about 16 miles north of Spartanburg. The proposed plant will develop about 4000 hp. and will cost about $300,000.

SUMMERTON, S. C.—Bonds to the amount of $6,000 have been voted to complete the municipal electric-light plant.

METTER, GA.—The City Council has engaged W. M. Crook, Grand Building, Macon, engineer, to supervise the construction of the proposed municipal electric-light plant. The cost of plant is estimated at $8,500.

ROYSTON, GA.—J. B. McCrary & Company, of Atlanta, has been engaged as engineer for the proposed hydroelectric power development on Broad River about 8 miles from Royston. The cost of the plant is estimated at $300,000.

HAVANA, FLA.—Bonds to the amount of $20,000 have been voted for the construction of an electric-light plant and waterworks system in Havana.

TARPON SPRINGS, FLA.—The City Council is considering the installation of a municipal electric-light system.

BENTON, TENN.—The Tennessee Power Company of Chattanooga contemplates extending its transmission lines to Benton, where a substation will be erected.

COLUMBIA, TENN.—Improvements are contemplated by the Columbia Water & Light Company, including the installation of a prime mover of 500 hp. to drive generator of same capacity and electrically-driven pumps of about 1,000,000 gal. daily capacity.

LEWISBURG, TENN.—The property of the Lewisburg Light & Power Company has been purchased by the Public Light & Power Company, with head office in Chattanooga. The new company is now operating in about twenty towns in this district and expects to erect a transmission line to connect Lewisburg with its system at an early date.

BROOKSVILLE, MISS.—The Council has decided to submit the proposal to issue bonds for the construction of a municipal electric-light plant to the voters.

McCOMB, MISS.—Bids will be received by the Mayor and Board of Selectmen of the city of McComb, Miss., until June 20 for furnishing and installing steam heating system, plumbing and electric wiring in the new high school building. Xavier A. Kramer of Magnolia is engineer.

WAYNESBORO, MISS.—The plant and holdings of the Waynesboro Electrical Company will be sold at public auction on June 15 by W. M. McAlister, receiver. The plant is equipped with both water and steam power and originally cost about $12,000.

FOREMAN, ARK.—A company has been organized with a capital stock of $3,600 for the purpose of installing an electric-light plant. C. B. Cook, T. F. Hughes and B. M. Mauldin are interested.

FORT SMITH, ARK.—Surveys are being made by the Fort Smith Light & Traction Company for an extension of the Van Buren line to the smelter of the Arkansas Zinc Company, and possibly to Alma.

HARRISON, ARK.—Bids will be received by W. F. Gordon, chairman of board of commissioners of water improvement district No. 1, Harrison, until June 26 for construction of system of water-works as follows: (a) Power house; (b) one triplex power pump; (c) one oil engine or electric motor; (d) reinforced concrete reservoir; (e) pipe lines, hydrants, valves, etc.; (f) resetting old machinery and renewing old pipe. Bids will be received on the entire work or for any part of the material. W. O. Galbreath of Harrison is consulting engineer.

MARVELL, ARK.—The town of Marvell (1000 population) is prepared to grant a franchise for an electric-light plant and water-works system. For further information address J. M. Farrar.

BLACKWELL, OKLA.—Bids will be received by the city of Blackwell until June 14 for furnishing material and equipment (f.o.b. Blackwell) for an ornamental street-lighting system, including 110 single-lamp standards complete, 10,000 ft. No. 8, two-conductor steel taped treated jute covered lead cable, two 30-kva., 2300-volt, 60-cycle, constant current transformers, one blue Vermont marble switchboard panel with equipment, four Horn type lightning arresters, four 60-amp., 5000-volt choke coils. Specifications are on file in the office of the city clerk, Blackwell. Copies may be obtained at the office of the Benham Engineering Company, Colcord Building, Oklahoma City, upon payment of $2. Clyde V. Butcher is city clerk.

HANNA, OKLA.—A franchise has been granted to the Canadian Valley Ice, Light & Fuel Company to construct and operate an electric-lighting system in Hanna.

ALVIN, TEX.—The property of the Alvin Ice, Light & Power Company has been taken over by W. P. Davis and W. L. Kinney of Alvin. Improvements, it is understood, will soon be made to the plant.

AUSTIN, TEX.—Wrights Brothers of San Antonio have been awarded the contracts for the electrical work in the State Capitol and the new State Blind Institute, at $18,582 and $19,443, respectively. Bids for the elevator in the State Capitol were rejected. New bids, it is expected, will soon be asked for.

DALLAS, TEX.—The North Texas Pre-Pay Fan Company is reported to be contemplating the installation of an electric lighting, heating and power plant in Dallas. E. H. Thornhill is promoter.

GRANGER, TEX.—The local electric-light, owned by the Granger Mill Company, has been taken over by the Texas Power & Light Company of Dallas. Improvements are contemplated by the new owner.

McKINNEY, TEX.—The City Council is contemplating the installation of a new electric-lighting system for the business district.

SHERMAN, TEX.—At an election to be held June 24 the proposal to issue $160,000 in bonds will be submitted to the voters. Of the proceeds $10,000 will be used for a municipal fire-alarm system and $10,000 for street-lighting system.

Pacific States

NORTH YAKIMA, WASH.—The County Commissioners are reported to be considering the installation of an independent light and water plant.

OREGON CITY, ORE.—The cost of installing a complete electric generating plant, using the water wheels now installed but not in use, to be operated with water from the city's own flume, is estimated at about $4,000. Estimates for the installation of a distributing system have not yet been prepared.

SEASIDE, ORE.—The Pacific Power & Light Company of Portland, which recently purchased the plant of the Seaside Light & Power Company has petitioned the City Council for a 25-year franchise. The company proposes to close down the local plant and extend its transmission line from Astoria to Seaside to supply electricity for the local service.

RIVERSIDE, CAL.—Arrangements have been made between the Southern Sierras Power Company, Riverside, and the Southern California Edison Company of Los Angeles, whereby at all times the transmission lines of both companies will be connected, giving to each in case of emergency the benefit of service from the other.

TULARE, CAL.—Plans are being considered by the Merchants' Association for the installation of an electrolier street-lighting system in Tulare.

BANCROFT, IDAHO.—The Utah Power & Light Company of Salt Lake City, Utah, has been granted permission to extend its electric transmission lines in Southeastern Idaho to serve the towns of Alexander and Bancroft in Bannock County.

HAILEY, IDAHO.—The city of Hailey has entered into a contract with the Hailey Electric Company for a period of five years, which provides for an increase of service from 5800 to 7000 cp. The company agrees to install new equipment and improve the service at once.

POCATELLO, IDAHO.—Plans are being prepared for the construction of an electric railway from Pocatello to Idaho Falls via Blackfoot, a distance of about 5 miles. Charles E. Harris of the United States Land Office may be able to give further information.

CHLORIDE, ARIZ.—Application has been made to the Board of Supervisors of Mohave County by Robert Roe for a franchise to install and operate an electric-light plant in the town of Chloride and over and along the roads and highways in and about the town of Chloride.

PHOENIX, ARIZ.—Petitions are being circulated asking the City Commission to call an election to submit to the voters the proposal to issue $600,000 in bonds for the construction of municipal electric light and gas plants.

BILLINGS, MONT. — The Mountain States Telephone & Telegraph Company is planning to rebuild its local system this summer, at a cost of about $85,000.

HINSDALE, MONT.—The Council is considering calling an election to submit to the voters the proposal to issue bonds for construction of an electric-light plant and water-works system.

Canada

WINNIPEG, MAN.—The city solicitor has been instructed to ask the Dominion Government, water power department, for a lease of Slave Falls on the Winnipeg River, for further extension of the municipal power department.

HAMILTON, ONT. — The Hamilton Hydro-Electric Department will petition the City Council for permission to issue $188,000 in bonds, the proceeds to be used for extensions.

SARNIA, ONT.—The city of Sarnia has taken over the power plant and distributing system of the Sarnia Gas & Electric Company and will operate it until the Ontario Hydro-Electric Power Company extends its lines to Sarnia. The system will be changed from 60 cycles to 25 cycles when energy is received from the Hydro-Electric Commission.

STRATFORD, ONT.—The Public Utilities Commission has adopted the recommendation of the Ontario Hydro-Electric Commission for extensive alterations in the local powerhouse and authority has been given the provincial commission to advertise for tenders for the work. It is proposed to replace the present transformers with three transformers of 750 kw. each. The cost is estimated at about $35,000. F. A. Gaby is chief engineer of the Hydro-Electric Commission.

Miscellaneous

HILO, H. T.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 28, for furnishing and installing lighting fixtures in the United States post office, custom house and court house in Hilo. For details see proposal columns.

1,184,738. Switchboard Apparatus; A. F. Gilson, Closter, N. J. App. filed March 20, 1914. Party line indicating keys of the mechanically locking type.

1,184,741. Telephone-Exchange System; C. L. Goodrum, New York, N. Y. App. filed March 16, 1915. Metering system.

1,184,742. Telephone-Exchange System; C. L. Goodrum, New York, N. Y. App. filed April 9, 1915. Improved metering circuit arrangement.

1,184,745. System of Electrical Distribution for Projector Arc Lighting; J. H. Hallberg, New York, N. Y. App. filed July 17, 1915. Does not require the usual large resistance in series with the arc.

1,184,747. Lighting Fixture; M. Herskovitz, Chicago, Ill. App. filed June 1, 1915. Converts ordinary direct lighting fixture into semi-indirect fixture.

1,184,747. Pocket Flashlight; A. S. Lyhne, Bridgeport, Conn. App. filed Nov. 12, 1914. Pistol type.

1,184,782. Electric Welder; W. A. Smith, Windsor, Ont., Can. App. filed July 19, 1915. Concentric supports for the work holder.

1,184,783. Means for Observing and Signaling Between Ships in Fog; J. B. Speed, West New Brighton, N. Y. App. filed Sept. 4, 1914. Light is flashed from a point near the water line of the vessel.

1,184,805. Dynamo-Electric Machine; W. G. Wright, New Duluth, Minn. App. filed Aug. 15, 1912. Reduced number of bearings and sliding contacts.

1,184,813. Compression Type Seal; W. T. Birdsall, Montclair, N. J. App. filed May 4, 1915. Glass seal maintained under compression by a surrounding band of high-tension string.

1,184,817. Furnace; J. W. Brown, Lakewood, Ohio. App. filed Dec. 1, 1911. Has interior walls of carbon.

1,184,818. Dry Cell; J. W. Brown, Lakewood, Ohio. App. filed Dec. 1, 1911. Has filling mixture of super-baked petroleum coke.

1,184,824 Steadying Device for Vertical Arc Lamps; R. B. Chillas, Jr., Cleveland, Ohio. App. filed Jan. 23, 1912. Maintains uniform ends on the electrodes.

1,184,826. Apparatus for Interrupting Electric Circuits; W. Cooper, Pittsburgh, Pa. App. filed Feb. 23, 1912. Prevents "flashing over" of railway motors.

1,184,834. Metering Switch; G. C. Dill, Wilkinsburg, Pa. App. filed May 3, 1915. For changing connection between measuring instrument and several sources of current.

1,184,843. Signaling by Electromagnetic Waves; R. A. Fessenden, Fortress Monroe, Va. App. filed July 8, 1903. Secures freedom from outside disturbances.

1,184,844. Electric Circuit Interrupter; C. Le G. Fortescue, Pittsburgh, Pa. App. filed May 27, 1912. Depends upon sudden decrease of voltage.

1,184,846. Circuit-Interrupting Device; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Aug. 11, 1913. Anticipates a destructive current.

1,184,854. Process for Making Battery Depolarizing Material; M. E. Holmes, Lakewood, Ohio. App. filed Nov. 21, 1912. For midget batteries.

1,184,864. Electric Current Controller; C. Monninger, Macomb, Ill. App. filed July 7, 1915. Has a readily removal resistance core.

1,184,899. Mouthpiece for Telephone Transmitters; H. F. Vandervort, Loveland, Ohio. App. filed Dec. 12, 1914. Sanitary attachment for public phones.

1,184,909. Burglar-Proof Lock; J. Ziemienik, St. Clairsville, Ohio. App. filed July 17, 1915. Alarm sounded when an unauthorized key is inserted.

1,184,924. Dimming Device for Automobile Lamps; L. F. Chaney, Springfield, Ohio. App. filed April 6, 1914. Rheostat construction.

1,184,932. Automatic Telephone System; A. H. Dyson, Chicago, Ill. App. filed Oct. 31, 1905. Uses few electromagnets (125 claims).

1,184,933. Telephone System; A. H. Dyson, Chicago, Ill. App. filed Dec. 20, 1905. Visual signals notify operators of line conditions (eighty-nine claims).

1,184,934. Telephone System; A. H. Dyson, Chicago, Ill. App. filed April 27, 1906. Combined manual and automatic ninety-nine claims).

1,184,949. Heater for Dental Vulcanizers; W. A. Gwynn, St. Louis, Mo. App. filed July 1, 1915. Adjustable to receive vulcanizers of different sizes.

1,184,955. Testing System for Electric Circuits; H. L. Hoffman and J. O. Doolittle, St. Louis, Mo., and Emporia, Kan. App. filed Jan. 12, 1914. For rapidly locating breaks.

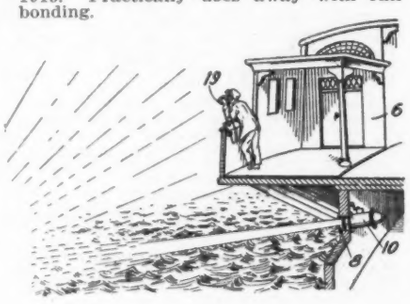
1,184,963. Insulator Pin; M. G. Kennedy, Philadelphia, Pa. App. filed Nov. 7, 1914. Wooden cap mounted on metal post.

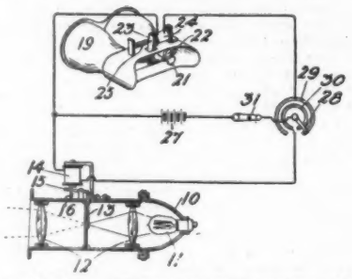
1,184,966. Lamp Socket; G. C. Knauff, Chicago, Ill. App. filed Feb. 4, 1915. Of simple construction for automobile lighting.

1,184,993. Battery Plate; G. H. Rabenalt, Buffalo, N. Y. App. filed Feb. 14, 1912. Grid substantially inclosed by the paste.

1,185,010. Electric Heater for Carburetors; W. S. Seederly, Columbiana, Ohio. App. filed Feb. 21, 1916. Heating unit detachably secured to carbureter.

1,185,024. Expediting and Safeguarding Railway Traffic; H. A. Thompson, Manchester, England. App. filed Jan. 27, 1915. Practically does away with rail bonding.





No. 1,184,783. Means for Observing and Signaling Between Ships in Fog.

1,185,030. Igniter for Internal Combustion Engines; E. G. Wayman, Swissvale, Pa. App. filed April 1, 1914. Compression operates make and break electrodes.

1,185,037. Circuit Closer for Trolley Signals; W. D. Wright, Providence, R. I. App. filed March 18, 1910. Prevents trolley being thrown from wire.

1,185,040. Mounting for Incandescent Lamps; R. W. Armstrong, New York, N. Y. App. filed March 16, 1915. For telephone switchboards.

1,185,058. Separator; R. N. Chamberlain, Chicago, Ill. App. filed June 20, 1914. Vulcanizes rubber on ribs of wood plate.

1,185,085. Elevator Signal; R. H. Gaylord, Pasadena, Cal. App. filed March 9, 1915. Operator can make telephonic announcement at different floors.

1,185,086. Lock-Out for Party Lines or Extension Telephones; C. L. Goodrum, New York, N. Y. App. filed Dec. 5, 1914. Particularly for automatic systems.

1,185,087. Lock-Out for Party Lines or Extension Telephones; C. L. Goodrum, New York, N. Y. App. filed Dec. 5, 1914. Has a cut-off relay and a cut-in relay.

1,185,123. Electric Switch Apparatus; F. D. Morris, Creston, Iowa. App. filed Oct. 18, 1913. Distributing board construction.

1,185,141. Knife Switch; H. F. Starrett, Chicago, Ill. App. filed May 13, 1912. Removably mounted on panelboard.

1,185,144. Tank Alarm; J. J. Stukel, Laurin, Mich. App. filed April 9, 1915. Succession of lights indicate to chauffeur consumption of gasoline.

1,185,151. Electrical System for Auto-Vehicles; R. Varley, Englewood, N. J. App. filed June 17, 1912. Lighting and ignition generator.

1,185,168. Means for Connecting Electrical Appliances to Conduit Boxes; A. H. Bissell and J. J. Dossert, Syracuse, N. Y. App. filed Dec. 27, 1910. For mounting switches and the like on outlet boxes.

1,185,211. Circuit Closer for Gas Alarms; A. Di Legge, New York, N. Y. App. filed May 14, 1914. Indicates pressure of dangerous gas.

1,185,218. Potential Starter; A. J. Loguin Norwood, Ohio. App. filed March 23, 1912. Prevents opening of starter on low or no-voltage circuit conditions.

1,185,227. Electrical Resistance; G. Mascarini and A. Contardi, Milan, Italy. App. filed Jan. 3, 1914. Homogeneous body of iron sulphide.

1,185,240. Electrical Relay; A. Petersen, Copenhagen, Denmark. App. filed Jan. 9, 1914. Vibrating contracts inclosed in chamber.

1,185,251. Timer Control in Electrically Operated Musical Instruments; M. L. Severy, Arlington Heights, and G. B. Sinclair, Boston, Mass. App. filed June 19, 1907. Changes pitch of piano strings without altering their length.

1,185,288. Duplex Driving Mechanism; C. W. E. Clarke, Brookline, Mass. App. filed Jan. 4, 1915. Eliminates need for manually rendering reserve motor effective when its companion fails.

1,185,306. Fire Alarm System; G. Groves, Parry Sound, Ontario, Canada. App. filed Aug. 31, 1915. Circuit may be tested at any time without sounding alarm.

1,185,331. Telephony; M. L. Johnson, Chicago, Ill. App. filed Feb. 24, 1913. Desired numbers are automatically recorded.

1,185,332. Electric Relay; C. P. G. Joubart, St. Denis, France. App. filed June 4, 1914. Automatic cut-out.

1,185,363. Secret Branch or Private Exchange Switchboard; R. M. Beard, New York, N. Y. App. filed April 15, 1914. Parts sealed within closed cabinet.

1,185,366. Dynamo-Electric Machine; A. Burke, Erie, Pa. App. filed Oct. 9, 1907. Construction of stationary element.

1,185,369. Relay; F. B. Cook, Chicago, Ill. App. filed Dec. 14, 1914. Minimum movement of armature.

1,185,370. Relay; F. B. Cook, Chicago, Ill. App. filed Dec. 14, 1914. Armature made up of two single-piece armatures.

1,185,371 Relay; F. B. Cook, Chicago, Ill. App. filed Dec. 14, 1914. Improved means for adjusting floating spring contacts.

1,185,372. Telephony; E. R. Corwin, Chicago, Ill. App. filed April 5, 1913. Arrangement of selector switches (124 claims).

1,185,373. Telephony; E. R. Corwin, Chicago, Ill. App. filed Jan. 16, 1914. Operator and electromagnetic control.

1,185,374. Telephony; E. R. Corwin, Chicago, Ill. App. filed Jan. 15, 1915. Party line system.

1,185,375. Telephony; E. R. Corwin, Chicago, Ill. App. filed July 30, 1915. "Holding" switches, etc. (ninety claims).

1,185,376. Telephony; E. R. Corwin, Chicago, Ill. App. filed July 30, 1915. Each group of line switches provided with a master switch (seventy-six claims).

1,185,379. Starting and Regulating of the Speed of Dynamo Electric Machines; F. Cumont, Paris, France. App. filed Jan. 16, 1914. Circuits controlled from circuits through which main motor current is not passed.

1,185,394. Process of Melting Scrap Metal; A. E. Greene, Chicago, Ill. App. filed Jan. 23, 1911. Charges steel scrap in a bath in electric furnace.

1,185,395. Process of Melting Steel Scrap; A. E. Greene, Chicago, Ill. App. filed Dec. 18, 1912. Saves manganese and silicon from manganese steel scrap.

1,185,396. Process of Refining Ferro Metals; A. E. Greene, Chicago, Ill. App. filed Dec. 27, 1912. Decarbonizing high-carbon metal.

1,185,397. Combined Process of Refining Metal and Reducing Ore; A. E. Greene, Chicago, Ill. App. filed Dec. 27, 1912. Removes phosphorus and sulphur.

1,185,407. Electrolytic Cell; H. C. Jenkins, London, England. App. filed Nov. 9, 1915. Electrolytic action concentrated upon the electrodes.

Record of Electrical Patents

Notes on United States Patents issued May 30, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.